

# THE BRICKBUILDER

VOL. III.

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No. 8.

## BRICK AND MARBLE IN THE MIDDLE AGES.

### CHAPTER VI.—CONTINUED.

AND now that we have visited two of the great churches, we must no longer delay our visit to the church of Sta. Maria l'Antica, whose small burial ground is fenced from the busy thoroughfares, which on two sides bound it, by an iron railing of most exquisite design, divided at intervals by piers of stone, on whose summits stand gazing upward as in prayer, or downwards as in warning to those who pass below, a beautiful series of saintly figures. Within, a glorious assemblage of monuments meets the eye—one over the entrance doorway, the others either towering up in picturesque confusion above the railing, which has been their guardian from all damage for so many centuries, or meekly hiding their humility behind the larger masses of their companions.

The monuments are all to the members of one family—the Scaligeri—who rose to power in the thirteenth century, and held sway in Verona until almost the end of the fourteenth. In this space of time, it was, therefore, that these monuments were erected, and they are consequently of singular interest, not only for the excessive beauty of the group of marble and stone which, in the busiest highway of the city, among tall houses and crowds of people, has made this churchyard, for some five hundred years, the central point of architectural interest, but because they give us dated examples of the best pointed work during nearly the whole time of its prevalence in Verona. In the monument of the first Duke we see the elements of that beauty which, after ascending to perfection in that of another, again descends surely and certainly in the monument of Can Signorio, the largest and most elaborate of all, and, therefore, I am afraid, the most commonly admired, but the one which shows most evidence of the rise of the Renaissance spirit, and the fall of true art. Nor is it, I think, to be forgotten, as an evidence of the kind of moral turpitude which so often precedes or accompanies the fall of art, that this Can Signorio first murdered his own brother, Cangrande II., that he might obtain his inheritance, and then, before he died, erected his own monument, and adorned it with effigies of SS. Quirinus, Valentine, Martin, George, Sigismund, and Louis, together with allegorical figures of the Virtues with whom he, of all men, had least right to associate himself in death, when in life he had ever despised them. The inscription, which records the name of the architect on this monument, does but record the vanity of him who was content thus to pander to the wretched Can Signorio's desire to excuse the memory of his atrocious life by the sight of an immense cenotaph.<sup>1</sup>

The tomb of Cangrande I. forms the portal of the church, as well as the monument of the first and greatest of the family. It is, perhaps, altogether, the finest of all; the shafts which bear the pyramidal canopy are supported on corbels; between them is a simple

sarcophagus sculptured with a bas-relief, and upon it lies Cangrande with his arms crossed in token of his resignation and faith. At the top of the pyramidal covering is the figure of the brave knight riding forth to war on his gayly caparisoned steed.

Next to this monument in date, as in merit, is that of Mastino II., wanting, perhaps, in some of the severe simplicity of the other, but even more striking, as it stands at the angle of the cemetery. It is a thoroughly grand and noble erection of two stages in height, the lower unimportant, and only serving as a means of raising the monument sufficiently high to be well seen from the exterior; upon this stand four shafts, between which, and supported upon four much smaller shafts, is the sarcophagus, on which lies the recumbent effigy, at whose head stand angels with expanded wings<sup>2</sup> guarding the deceased. The sarcophagus is adorned with bas-reliefs—that on the west side being the Crucifixion—and has engaged angle shafts. The four main bearing shafts at the angles of the monument have finely carved caps with square abaci, from which rise simple trefoiled arches, with steep pediments on each side filled with sculpture in relief, and between these are exquisitely simple niches, each a miniature reproduction of the entire monument, and containing between their delicate detached shafts figures of saints. The whole is finished with a heavy pyramidal capping, crocketed at the angles with crockets so abominable in their shape and carving that they go far to spoil the entire work, and surmounted by the figure of the Capitano del Popolo, spear in hand, riding on his war-horse; the horse and horseman riding with their faces towards the setting sun, as all in life must ever ride; the effigy below lying so that at the last day the beams of the day-star in the East may first meet its view, and awaken him that sleepeth here in peace.

This contrary position of the figure in life and in death, observed also in others of these monuments, is an evidence of the care and thoughtfulness with which every detail of these noble works was wrought out.

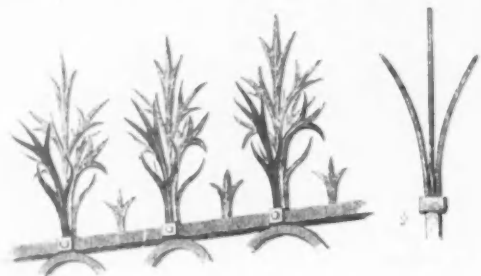
The monument of Can Signorio is not worthy of so long a description; it is octagonal in its plan, and in many respects below the idea shadowed out so beautifully in the others; the reduplication of niches and gables, far from improving, only perplexes the design; and when to this is added that the carving throughout, as well as the other details, show strong signs of a leaning towards Renaissance, one may see some reason why this, the most elaborate and complicated of all the monuments, is, after all, far from being the most successful.

Mastino II. died in the year 1351, and we may therefore, I think, look upon his monument as a fair enough example of Italian architecture just at the period at which in England it had reached its culminating point, and a careful examination of it cannot, therefore,

<sup>1</sup> It is not a little remarkable that this should be the monument a copy of which the late Duke of Brunswick desired in his will to have erected over his grave.

<sup>2</sup> The wings of these angels are of metal, though the figures themselves are marble.

be thrown away. In the first place, I must notice that the sculpture, which has the air of being rather sparingly used as too sacred a thing to be idly or profusely employed, is exceedingly good. The foliage is almost always very closely copied from natural forms,

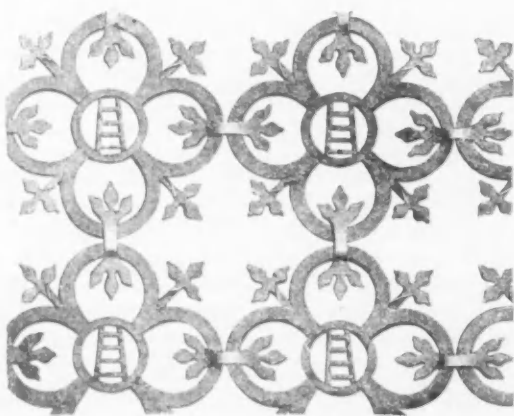


CREST OF METAL RAILING, VERONA.

is very thin and delicate in its texture, and thus really presents to the gazer that idealized petrification of nature which it ought always to be the sculptor's effort to give, and not, as is, I fear, sometimes the case, even in good English work, so profusely scattered over the whole surface as to give one a sense of its lack of great value. The worst part of the carving is, as I have before said, that of the crockets, which are as bad as the worst modern Gothic could be. The sculpture of the human figure is throughout very good: remarkable for simple, bold, deep folds in the draperies, quite Gothic in spirit, and much more akin to our best fourteenth-century work than to any classic examples.

As an example of the science of moulding this work is, however, valueless: there is absolutely no moulding upon it; and why should there be? Would it have been well that the lovely marble, whose brilliant white gloss was sure ere long to be stained with dark streaks of black by the beating of rain and the staining of age, whilst here and there the white would stand out more brilliantly than ever, — would it have been well, I say, that this should have been still further streaked with deep lines of many mouldings? Most assuredly not: the architect had to deal with a material which best takes its polish and exhibits its beauty and purity when used in flat surfaces and in shallow carving, and he did right therefore in not moulding it as he would have moulded stone.

There is a sharpness and hardness about the lines of the arches, however, which perhaps almost verges upon rudeness, and though I can see that it may be fairly defended, I could yet wish that it might have been softened.



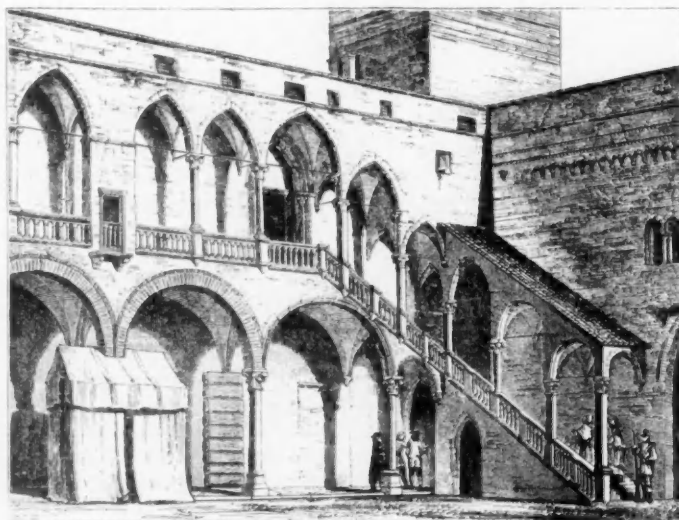
METAL RAILING, VERONA.

But the points in which such work is a grand example to us are, first, the value which it shows that we ought to place upon the simple detached circular shaft, and, next, the beauty and strength of effect which the cusping of a large arch in a proper manner gives. In these two points this monument and most of its class teach us lessons

which we ought not to be unwilling to learn, and which, if we at all wish to develop beyond the point at which our own ancestors ever arrived, we must not fail to attend to in our own work.

And now I must bid farewell to this lovely spot, the most attractive certainly, to me, in Verona. The situation of the monuments rather huddled together, with the old church behind them, the archway into the Piazza dei Signori on the other side, and the beautiful iron grille<sup>1</sup> which surrounds them, the number of saintly and warlike figures, and the confused mass of pinnacle and shaft, half obscured by the railing, do, I verily believe, make the cemetery of Sta. Maria l'Antica one of the best spots in the world for the study of Christian art in perfection. What either Köln or Regensburg Cathedral, or the Wiesen-Kirche at Söest is to Germany, the Choir of Westminster Abbey or the Chapter-House at Southwell to England, Amiens Cathedral or the Sainte Chapelle of Paris to France, such is the cemetery of the Scaligeri in Verona to Italy — the spot where, at a glance, the whole essence of the system of a school of artists may be comprehended, lavished on a small but most stately effort of their genius.

Close to their burial place stands also the Palace of the Scaligers. The old portion of this fronts towards the Piazza dei Signori, a small square used only by foot passengers, and surrounded by elaborate Renaissance work. The buildings surround a quadrangle — the Mercato Vecchio — out of one angle of which rises the immense campanile which I have already noticed, and which is said to have



COURTYARD OF THE PALAZZO SCALIGERI, VERONA.

been erected by Can Signorio about A. D. 1368, though I should have thought that a rather earlier date would have tallied better with its style. Besides this the most striking feature is the external staircase in the courtyard, whose treatment, of a kind not uncommon in ancient Italian architecture, is very beautiful, though I fear very weak and unstable, if I may judge by the number of the iron bars by which it is held together. There are many windows here of very good detail, and an arcaded cornice all round the courtyard, and close by and also facing the Piazza dei Signori there is another fine lofty battlemented tower.

In a street close to the monuments of the Scaligers, whose name I have forgotten, but in a line with the Viccolo Cavaletto, I found a most valuable example of domestic work in a very fairly perfect state. As far as I could make it out, it consisted originally of three sides of a quadrangle, the fourth side towards the street being enclosed by a wall and arched gateway. The buildings all had arcades on the ground level, forming a kind of cloister, and the staircase to the first floor was external, and built against the wall on the road side. A

<sup>1</sup> This grille is worthy of special notice. Instead of being hard and stiff, it is all linked together, so that it is more like a piece of chain mail than of iron railing. Its intricacy adds manifold to the effect of the group of tombs which it half conceals.



J MONUMENT OF MASTINO II, VERONA.

SUPPLEMENTARY ILLUSTRATION TO "BRICK AND MARBLE IN THE MIDDLE AGES."



great many alterations have been made in the house at various times, but in the sketch which I give I have shown so much only of it as appeared to belong to the original foundation. In its construction pointed and round arches have been used quite indiscriminately, and in some of the arches the depth of the voussoirs increases towards the centre of the arch. This is a rather favorite Italian device, and I was always as much pleased as at the first with the effect of strength and good proportion which it produces. Most of the arches are built with alternate voussoirs of brick and stone, but beyond the outside line of the brick and stone arch there is invariably a line of very thin bricks laid all round the arch, delicately defining without pretending to strengthen the main arch, just as a label does with us.

I noticed too, generally, that this thin brick was of a deeper, better color than the other bricks, which are seldom any better than the common English bricks, and are always built with very coarse joints. This house is finished at the top with the quaint forked or swallowtailed Ghibelline battlement, so characteristic of Verona, and which, as we found afterwards, was in use at Mantua, Cremona, and for some distance south of Verona, but which I first met with in Verona.

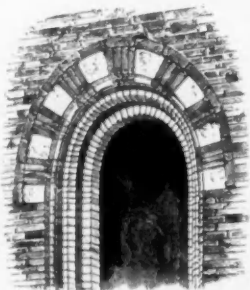
I am not pretending to journalize regularly, but rather to note down the remarkable points of the various buildings as they occur to me, and, before I forget that it was Sunday when I was first looking at the Veronese churches, I must mention that in the evening we found our way to the great Piazza di Brà, surrounded by barracks and public buildings, and containing the vast Roman amphitheatre for which Verona is so celebrated. Its size is prodigious, and, except in the outer circuit of wall, it is nearly perfect; indeed, it is impos-



WINDOW, VERONA.

sible to look upon such a vast structure without a great admiration for the men who ventured to conceive and carry it into execution.

It is difficult now to conceive how the audience could be found who would fill so vast a space; and certainly the modern efforts in this direction are mainly serviceable as showing the immensity of the theatre. When I was last in Verona a theatre had been erected in the arena, and a performance was in progress. The audience might have been tolerably large in an enclosed theatre, but here it seemed to be the merest handful; and when we stood on the highest attainable part of the walls, we found ourselves so far from the stage as to be unable to hear a single word that was said. There is no need to describe here so well-known a building as this; suffice it to say that

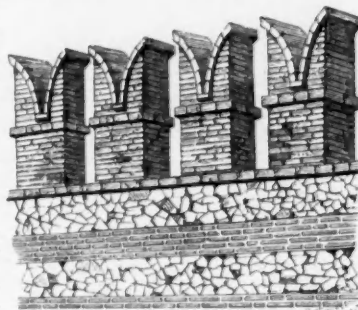


WINDOW, VERONA.

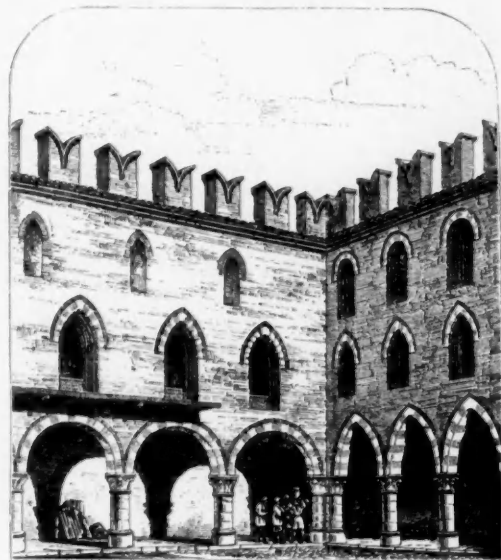
though the detail of the architecture is poor, the general design and execution of the structural arrangements and the magnificence of the whole scheme cannot fail to strike one with the same wonder that one feels in the presence of many of these great Roman works; and it is striking indeed to see one of them so perfect as to be still capable of use, and really used.

All the Austrian portion of the inhabitants of Verona crowded the Piazza di Brà on Sunday evening to hear an Austrian military band, and we enjoyed not

a little a stroll among a crowd of uniforms of all shapes, kinds, and colors. Verona more than most towns, even in Austrian Lombardy, seems to be sacrificed entirely to Austrian soldiery. It is quite melancholy to walk along a street of palaces, some of them converted into old-furniture stores, others going to ruin; and when suddenly you do come upon a flourishing and smart palace, if you look in you are sure to see an Austrian sentinel, and find that it is an officer's quarters; and equally when you meet a conveyance, if it is smart and dashing, with good horses and a stylish



VICCOLO CAVALETTO, VERONA.



COURTYARD OF OLD HOUSE, VERONA.

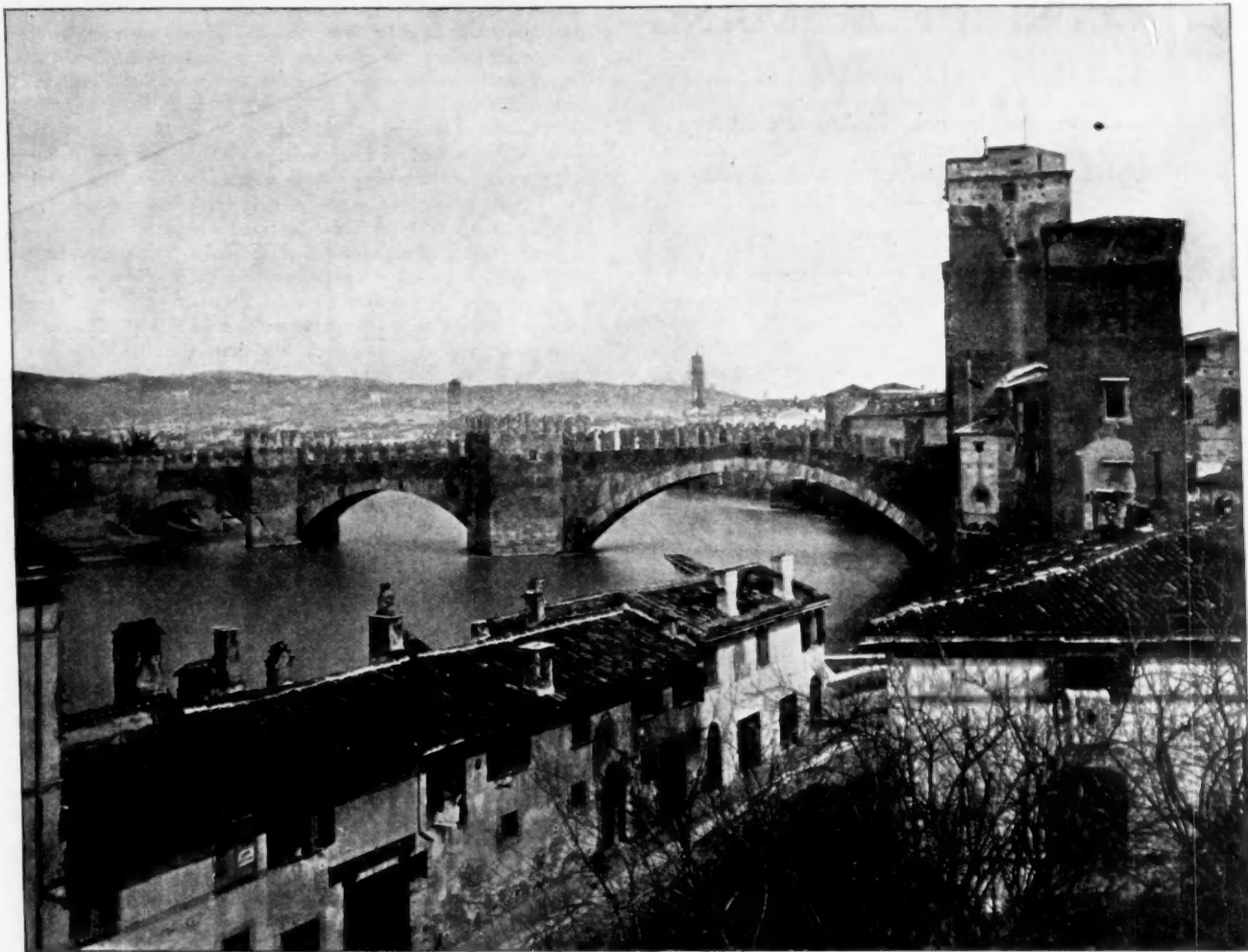
coachman, it is quite certain to be occupied by some dignified looking military man. So, too, on the Monday evening, when we went to the French opera (a very pretty, tastefully got-up theatre by the way), there were absolutely none but Austrians in the house,—in the boxes, officers and their wives; in the pit, subordinate officers and privates. Who can see this immense staff of foreigners in occupation of a city like Verona without feeling sadly for the people who live under such a rule, and for the ruler who is compelled to maintain such a force to keep his subjects in order? <sup>1</sup>

This, however, is a digression, and I must go on to describe the remaining architectural features of the old city.

On the way to San Zenone Maggiore, which is quite on the extreme western verge of the city, one passes the Castello Vecchio, a very grand pile of simple mediæval fortifications erected in the four-

<sup>1</sup> I need hardly say that all this is changed, and I hope changed for the better. The city looks more thriving than it did, and more of the old mansions are properly occupied than was the case in the time of the Austrians.





PONTE DI CASTEL-VECCHIO, VERONA.

SUPPLEMENTARY ILLUSTRATION TO "BRICK AND MARBLE IN THE MIDDLE AGES."

teenth century by Cangrande II. There are several towers and lofty walls, all topped with the forked Veronese battlement; and connected with it is the magnificent Ponte di Castel-Vecchio, a great bridge across the rushing Adige, built entirely of brick, the parapet of the regular Veronese type, and the piers between the arches rather large and angular, and finishing with battlements rather above those of the bridge. The main arch is of great size,—it is said to be not less than one hundred and sixty feet,—and one of the most remarkable points in its appearance is that, instead of being in the centre, it is on the side of the river next the castle, while the other two arches, descending rapidly to the north bank of the river, give the bridge an odd, irregular, and down-hill kind of look. The architectural features of this bridge are, however, not the only objects of interest on this spot; for just after passing the castle the road bends down to the side of the river, and presents an admirable view of the campanili, steeples, and spires, with the steep hills on the opposite bank of the stream, and the mountains in the distance, with the rapid, turgid, white-looking Adige flowing strongly at one's feet.

(To be continued.)

## CIRCULAR TERRA-COTTA WINDOW.

THE Carnegie Music Hall, on the corner of Fifty-Seventh Street and Seventh Avenue, New York City, contains a great deal of interesting detail in terra-cotta, one example of which, a circular window in the tower, is here published from a photograph of the terra-cotta set up at the works. Other details, comprising capitals, panels, brackets, consoles, and pilasters, will be published in subsequent issues. The terra-cotta, which is a pleasing shade of dark buff, was executed by the Excelsior Terra-Cotta Company of New York City. Mr. William B. Tuthill, 287 Fourth Avenue, New York, is the architect of the building.



## A CARD OF ACKNOWLEDGMENT.

THE editor of THE BRICKBUILDER has been greatly assisted in securing photographs to supplement the illustrations of "Brick and Marble in the Middle Ages," by Messrs. H. Langford Warren, Clarence H. Blackall, William Martin Aiken, Walter F. Price, Charles H. Muhlenberg, James C. Green, and Lyman A. Ford, who have opened their collections of photographs to him, and made it possible to very fully illustrate the buildings described in Mr. Street's book.

## THE ART OF BUILDING AMONG THE ROMANS.

Translated from the French of Auguste Choisy by

ARTHUR J. DILLON.

### CHAPTER II. — CONTINUED.

THE first several plates published with this treatise show the general appearance of the different parts of the frameworks of the vaults imbedded in the masonry they held up, and the sketches scattered through the text give more exact details of their construction. In general, one can readily understand their nature and the importance of their rôle. I have chosen from among the many different kinds of armatures a simple type, and have endeavored in the following drawing to show the aspect of the work while in process of building.

In the figure one can see the temporary centring, C D, a light framework of brick, bearing directly on the centring, and the masses of rubble, M, which, when finished, form the real vault. In the modern system of building the temporary centring, C, would support the entire vault and have to be capable of great resistance, and hence would be very expensive. Here, on the contrary, the wooden centrings support only the skeleton of the vault, D, an important difference, for it allows the resisting force of the centring to be reduced in proportion to the weight supported, that is to say, it permits a noticeable reduction of strength, and, therefore, of expense.

Re-enforced with the resisting lattice of brick which covered it, the temporary centring, C, was protected from any destructive action; it imparted its form to the rubble without supporting it, for, once it was in place, the brick armature became the real centring of the vault, and an essentially durable one, which remained in the body of the rubble, incorporated with it, and contributing as much as the rough masonry toward the solidity and preservation of the structure.

It is true that this second centring of brick imbedded in the masonry cost more than the amount of rubble of which it took the place; but this increase of cost was extremely small compared with the amount economized in the temporary scaffolding, and, moreover, the increase was, in itself, very insignificant.

The material of which the armatures were made was simply brick, of large dimensions, it is true, but of a manufacture which cost very little near Rome. Nevertheless, they were used very sparingly; instead of making the revetments which re-enforced and strengthened the centrings continuous, we saw that the Romans reduced it to an open network, doing away with almost half the bricks which would have been necessary to form a solid envelope to the centrings (Plate I.).

Frequently they limited themselves to isolated ribs, to transverse arches buried in the thickness of the masonry (Plates II., III., VII., VIII., IX., X., XI.).<sup>1</sup> Even these transverse arches are not made of solid masonry, but are hollowed in every way until they are but narrow networks of brick spaced along the vaults.

Finally, in certain cases, to diminish the expense caused by the thickness of a vault of bricks laid on end, the Romans made arma-

tures of bricks laid flat, which formed a kind of curved tiling over the centrings (Plate IV., Fig. 1). Sometimes two layers of this sort were placed one over the other, but the second was usually not continuous, and it would seem impossible to have a more economical arrangement (Plate IV., Fig. 3).

The cost of labor was even less than one would be led to expect by the ingenious, and, in some cases, studied combinations indicated by the drawings; everything was done in the most rapid, one might say, in the rudest manner possible. Before a Roman monument, one feels that ancient workmen learnt by practice to put up the brickwork of vaults offhand, saving all the time and pains compatible with the nature of the work. The appearance of these auxiliary works indicates the greatest precipitation; and the incorrectness of form is sometimes such that, in order to give an intelligible idea of the structure, I have been compelled to give in the drawings a regularity to the armatures which an examination of the ruins would, in more than one case, contradict.

Let us be careful, however, of reproaching the Romans with thoughtless negligence. Here to hasten work to such an extent as to make it incorrect was perhaps more a merit than a fault. In the auxiliary works of such building every increase of time which is not absolutely necessary should be regarded as useless, and the crude appearance of their vaults shows that the Roman workmen had a just appreciation of what was suitable. It was sufficient that these brick skeletons be put up strong enough to hold until the masonry was finished,

for once it was laid everything was swallowed up, imprisoned in its mass, and after the decoration was applied, the last traces of the supporting network, which might have been seen from underneath, disappeared under a thick coating of plaster. Under these conditions there was no advantage in careful work, the carelessly built Roman armatures sufficed, and more pains taken in their structure would have been a pure loss.

Aside from motives of economy the Romans had an important reason for avoiding delays. In order to explain fully the haste they showed in placing the sustaining works of the vaults, one must take into account the condition of the work-yard at the moment that the auxiliary constructions in brick were

about to be put up. The masonry of the uprights was finished, the temporary centring put in place; the architect then found himself in a difficult position; if he continued the construction of the masonry, he was in danger of breaking down the centring; if, on the contrary, he suspended the rough masonry work to take it up when the armature of the vault was finished, he would leave his whole troop of workmen and slaves unoccupied.

The only way to reconcile all conditions was to so hasten the placing of the armature as to have it completed before the masonry exerted any pressure on the centring. If, for example, A B represents the level at which the pressure begins, the moment the masonry reaches that level the arches must all be finished and the work present the appearance of this sketch (Fig. 14).

Armature and masonry, all the work was begun at the same time, but the armature had to be put in place and made ready during the short interval when the rubble of the vault could support itself. Hence the marked precipitation, whose need, one sees, was urgent. It was no less a question than that of temporarily leaving unoccupied all the numerous laborers on whom the Romans imposed the manual and ordinary parts of their great constructions. This first period, during which the entire interior scaffolding had to be raised in the greatest

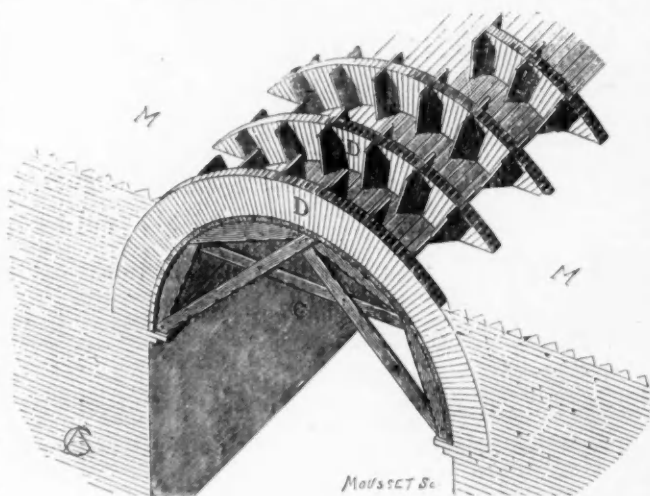


Fig. 13.

<sup>1</sup> Plate I. was published in May, Plates II., III., and IV. in this issue, and the others will appear later. — Ed.

haste, was the only critical one; the vault completed on this inflexible support was completed as easily as an ordinary wall, and when finally came the moment when it should be left to itself, the removal of the

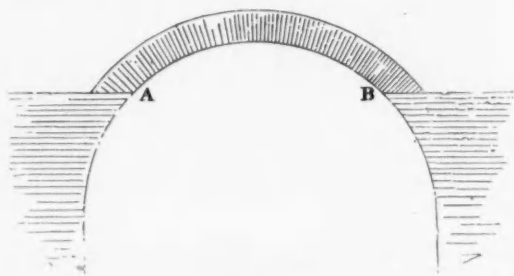


Fig. 14

centring which, in other systems, is such a delicate operation, was achieved without danger, or, rather, was a fictitious operation. There was no risk incurred in taking down the wooden centring; the real centring was the armature itself, swallowed up in the midst of the rubble, where it remained and supported the weight of the vault until all the mortar had set.

One can now conceive, as a whole, the successive steps in Roman construction, and see the advantages of the structure of ancient vaults, based, as we have shown on principles, essentially simple and practical. Some of these principles arise so naturally that one finds them under other forms, in architecture, in appearance most different to the Roman. I refer to the French architecture of the Middle Ages. Though the ribbed vaults of our cathedrals resemble Roman vaults neither in appearance nor conditions of equilibrium, the first being maintained by a complicated and scientific combination of thrusts and counter-thrusts, the stability in the others resulting simply from the monolithic form of their masonry, yet in the methods of construction the analogy is striking, the more so, because it is perhaps accidental. Who cannot perceive in the ribs of the vaults of the Middle Ages, the resemblance to ancient armatures? In one case the ribs are made of brick and swallowed up in the masonry, in the other they are in relief and support the panels of cut stone.

But the distinctions of form or material are here of little importance; the fundamental principle is the same in both cases, embedded or projecting; the ribs filled equivalent roles at least during the construction, and the more the external aspects differ the better one can appreciate how natural and general is the building of vaults of a second centring of masonry. It is not my place to foretell the transformations which the ingenious idea will undergo in future; but, at any rate, the various applications made of it by two profoundly different schools of architecture is an assurance of its fecundity, and certainly it would be worth while for builders to examine the resources which similar methods offer in our own day.

In terminating this first study of vaults in the buildings themselves it would be helpful to compare our hypotheses with indications in ancient writings, but unfortunately direct references to the subject are very incomplete, and the few allusions to it are very obscure. Vitruvius often uses the word "vault," but he nowhere enters into the details of their construction; and an analysis of his entire treatise would hardly show a single passage really enlightening us on this question, perhaps the most important in all the history of ancient construction. He dwells at length on the methods of imitating vaults by means of curved frames of wood covered with reeds and plaster, but one seeks in vain for any description of vaults properly so-called. This strange blank may be the result of an omission on the part of the author, or it may be the result of subsequent mutilation of his work; or perhaps be an indication of the state of the art of building at his time. The last is the conjecture to which I most incline, for it must be granted that the date of the most ancient vaults of great size which still exist gives it the appearance of truth.

In spite of the gaps and obscurities in his treatise, Vitruvius

always remained an authority among the Romans, and the authors who succeeded him usually contented themselves with reproducing in a less cumbersome and diffuse, and often less exact, form the information in his works. Thus Pliny, who wrote at a time when vaults with armatures were in general use, gives no details of their construction; and the agriculturist, Palladius, as well as an anonymous abbeviator of Vitruvius, keeps the same silence on methods applicable to real vaults, elaborating, as did the author they copied, those constructions of most mediocre importance which imitated the curvature of vaults without

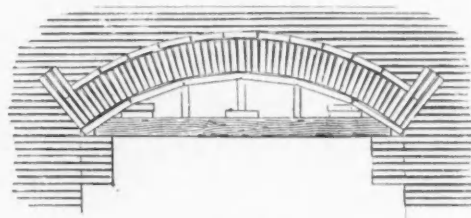


Fig. 15.

giving either their strength or durability. But though the support of writings fails us we can at least invoke that of tradition. The Italians of to-day are most economical of temporary constructions in wood when it is a question of centring for vaults, and it is not rare to find them using such expedients as that shown in Fig. 15. Here the permanent centring of the ancients is replaced by a layer of bricks laid flat, supported by a crosspiece of wood of a poor quality, and a few bricks on end; sometimes the Italians removed with the rest of the centring the course of flat-laid bricks which the Romans

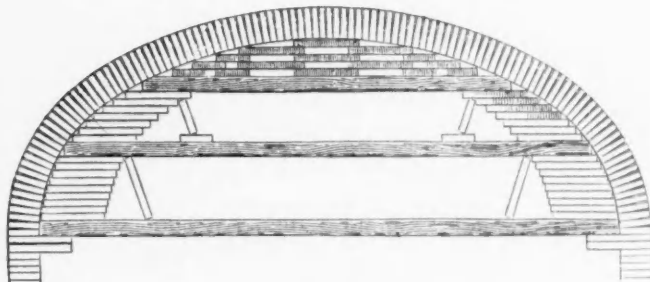


Fig. 16.

ordinarily left in place, but even in modern works I have often found vaults after completion lined with the curved courses which originally served as centres.

Another system of centring of brick conceived in almost the same spirit is shown in Fig. 16. Here the mould for the vault is



Fig. 17.

composed near the springing of two overhanging stacks of brick and near the summit of an open tympanum of bricks carried on a crosspiece of wood.

Fig. 17 is a last example of this system of centring; it consists of two pieces of wood leaning against each other and



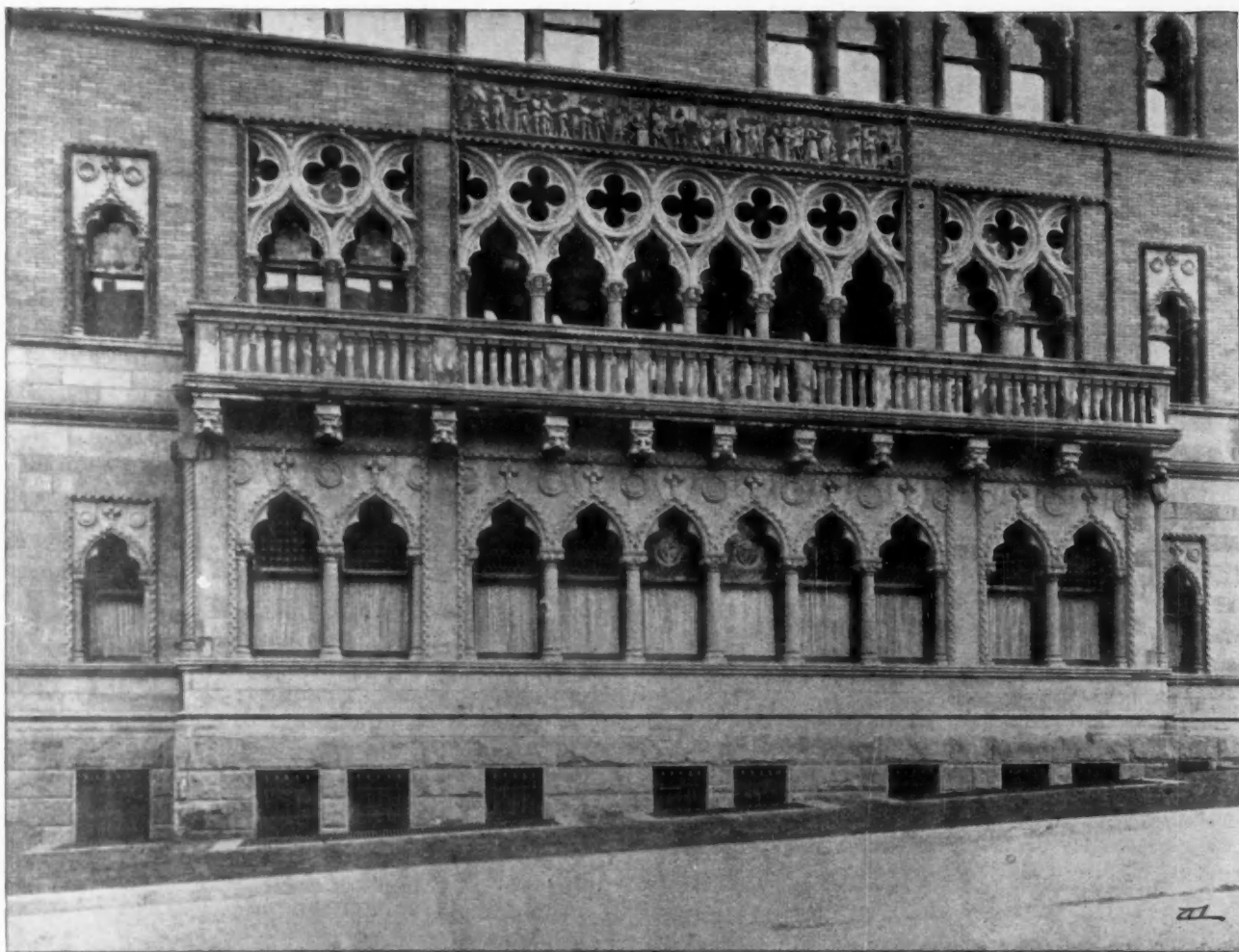
carrying a sort of irregularly built tympanum of brick which supports the vault while it is in course of construction.

Probably none of these three types of modern centres correspond exactly with those of antiquity; but it is, I think, impossible not to recognize the remarkable similarity of principles shown, for example, in the tendency to reduce the scaffolding to the greatest simplicity in the important part given to brick in the centrings, and in their use because of economy and lightness in the curved linings and open tympanums. We will often find, in the remainder of this study, other analogies between the construction of former days and that of modern Italy: often the examination of processes now in use will help us to understand those obscurely shown in the Roman ruins, or will at least give further guarantees of the truth of the explanatory hypotheses

*Architect staff.* This *chateau* is a combination of brick, laid in diaper pattern, and cut stone, of a character easily executed in terra-cotta. Although stone work is not in our line, we cannot pass over the charming design of St. Andrew's Church, Detroit, by Cram, Wentworth & Goodhue, shown in this issue, by a double plate of Mr. Goodhue's masterly pen drawings.

The same paper, on July 14, published a drawing by J. C. Halden, also on its staff, of Blackall & Newton's Tremont Temple, in which some very rich terra-cotta detail is shown.

The number for July 21 contains a simple and effective design for a Fire Station by Aaron H. Gould of Somerville, Mass., who has contributed several designs showing a reserved and intelligent handling of brick.



DETAIL FROM THE MONTAUK CLUB, BROOKLYN, N. Y.

TERRA-COTTA BY THE NEW YORK ARCHITECTURAL TERRA-COTTA CO. F. H. KIMBALL, ARCHITECT, 55 BROADWAY, NEW YORK.

we must build up. But let us return to the Roman armatures. They are divided, as we have seen, into two groups, one comprehending all the combinations of arches or networks with radiating joints, the other all those made of bricks laid flat: we will take up in turn their employment in the different kinds of vaults, and first of all in barrel-vaults.

(To be continued.)

#### BRICKWORK IN OUR CONTEMPORARIES.

IT is interesting to notice the increase in designs for brick and terra-cotta work published in the several leading journals of architecture, as indicating the strong leaning of architects towards these materials.

The *American Architect* of July 7 contains a good pen drawing of Chateau St. Agil in France, by W. Campbell, a draughtsman on the

The *Clayworker* has been publishing some very well-selected photographs of French and Flemish brickwork, which ought to give clayworkers pride in their art and its possibilities if nothing else will.

#### THE MONTAUK CLUB, BROOKLYN.

THE photographs published on this and page 156 are examples of very elaborate terra-cotta work, decidedly Venetian in style, designed by F. H. Kimball of New York, and executed by the New York Architectural Terra-Cotta Company. One of the most interesting features of the Montauk Club in the terra-cotta line is the legendary frieze, a portion of which is shown in the photograph on page 156. The figure work over the windows in the photograph above represents a historical scene in the colonial times of New York.

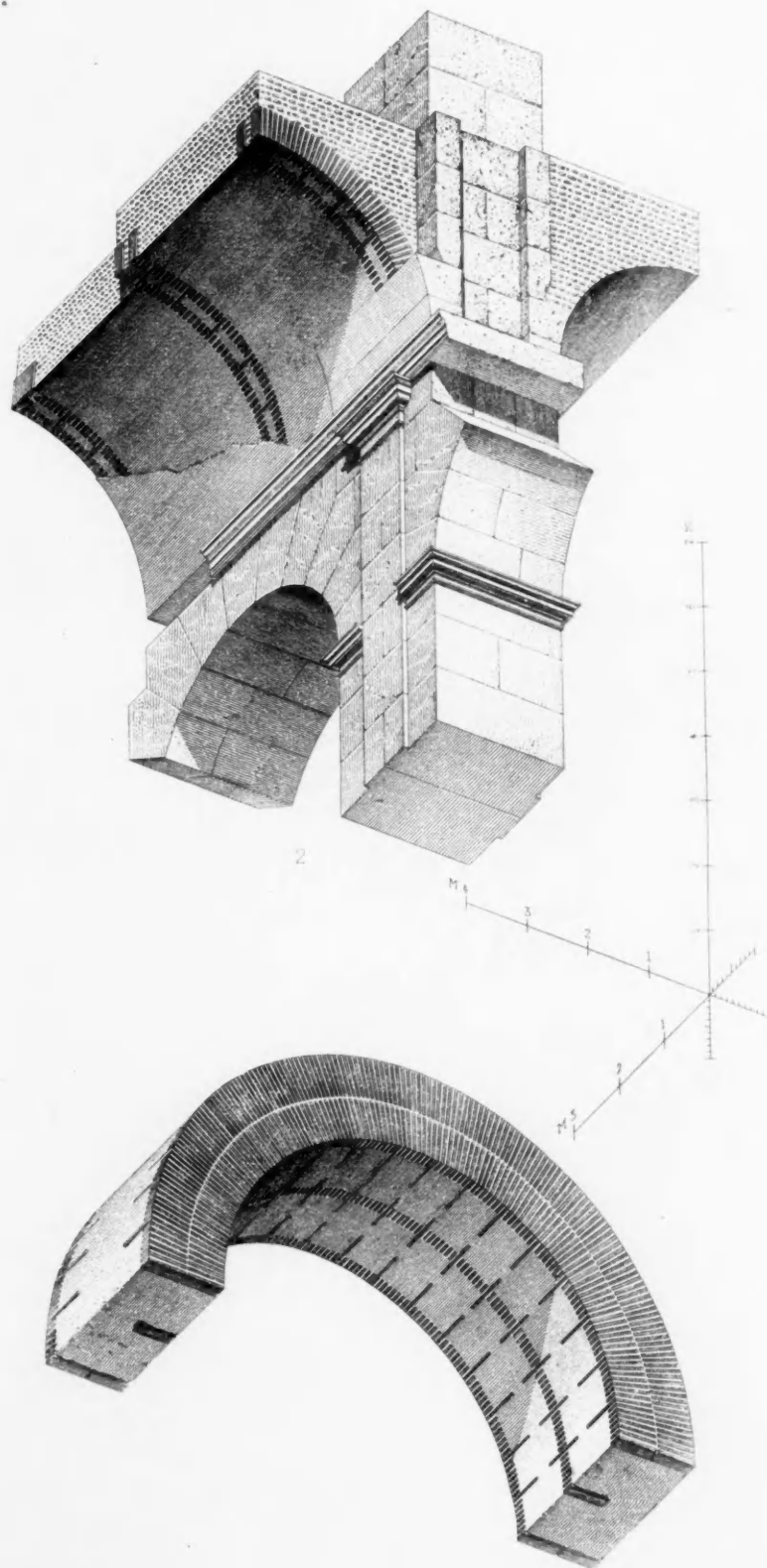


PLATE II. THE ART OF BUILDING AMONG THE ROMANS. SEE PAGE 152.

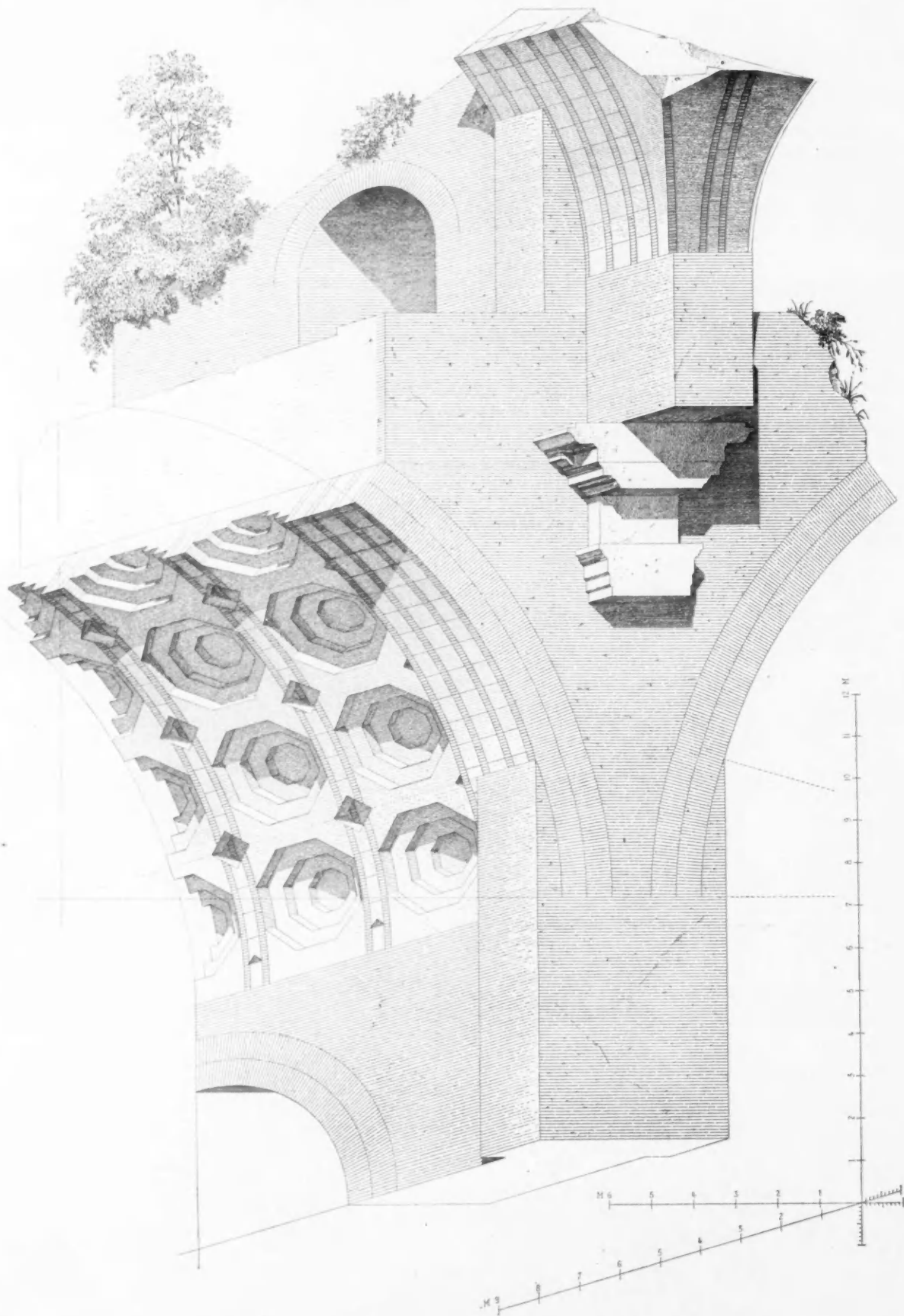


PLATE III. THE ART OF BUILDING AMONG THE ROMANS. SEE PAGE 152.



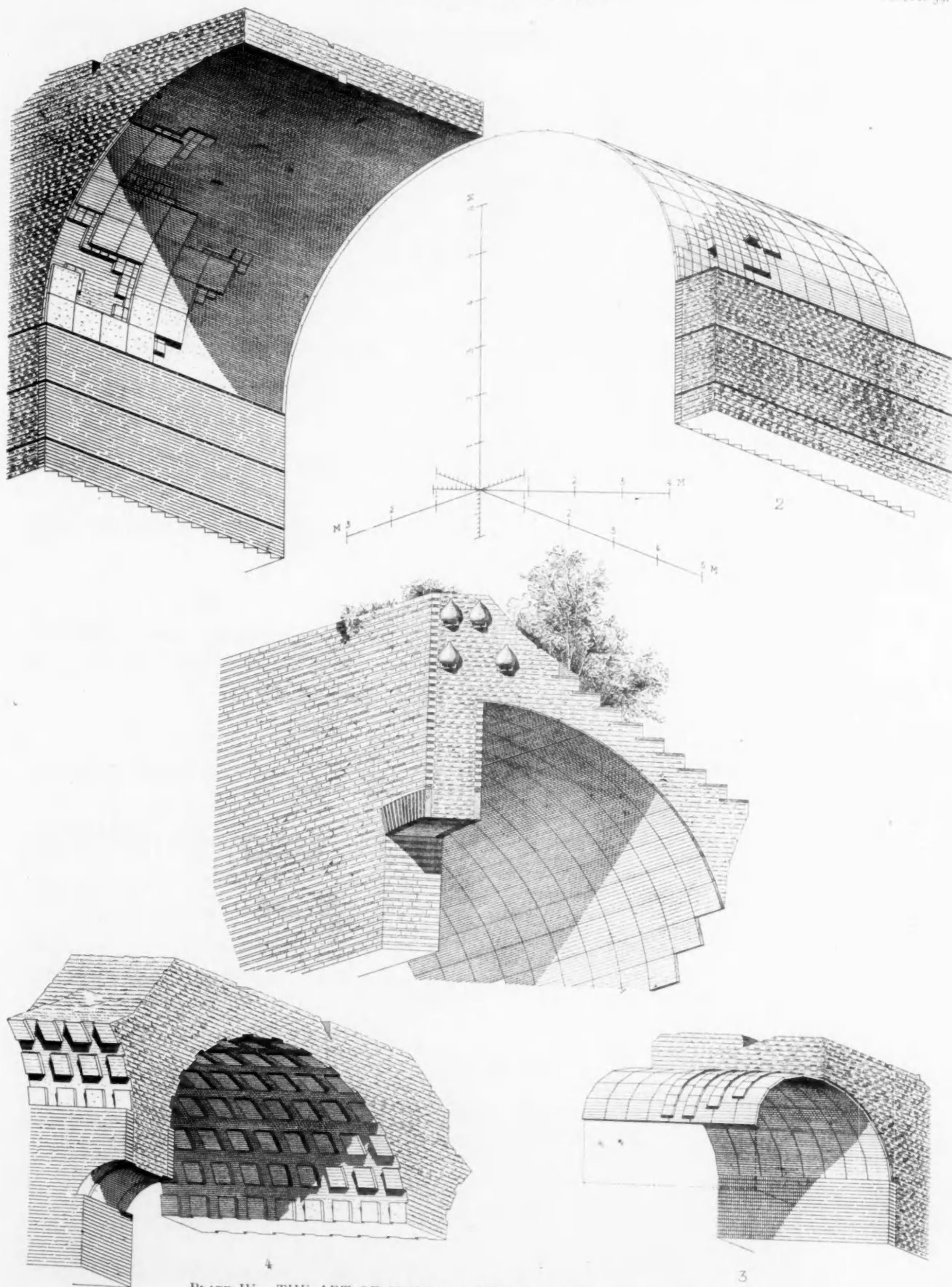
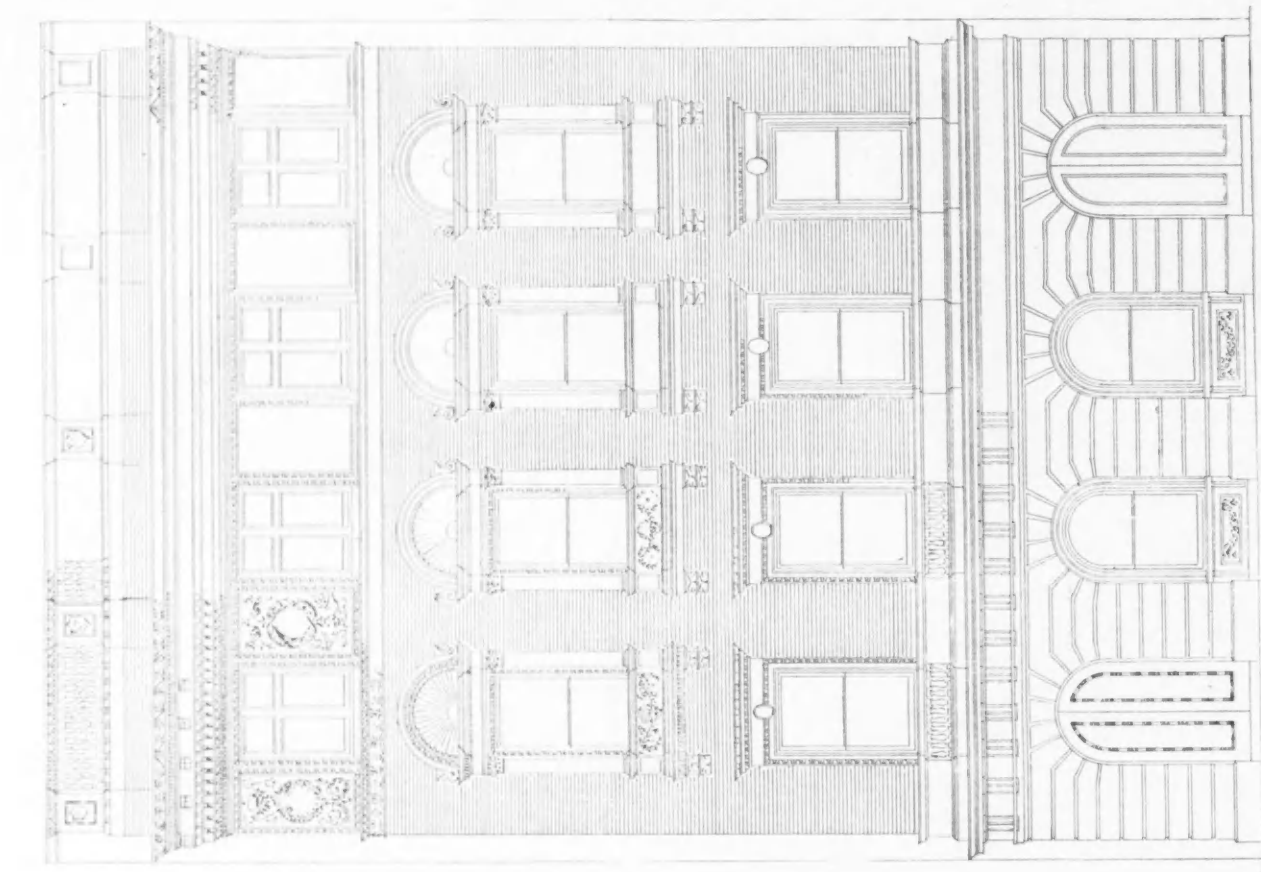
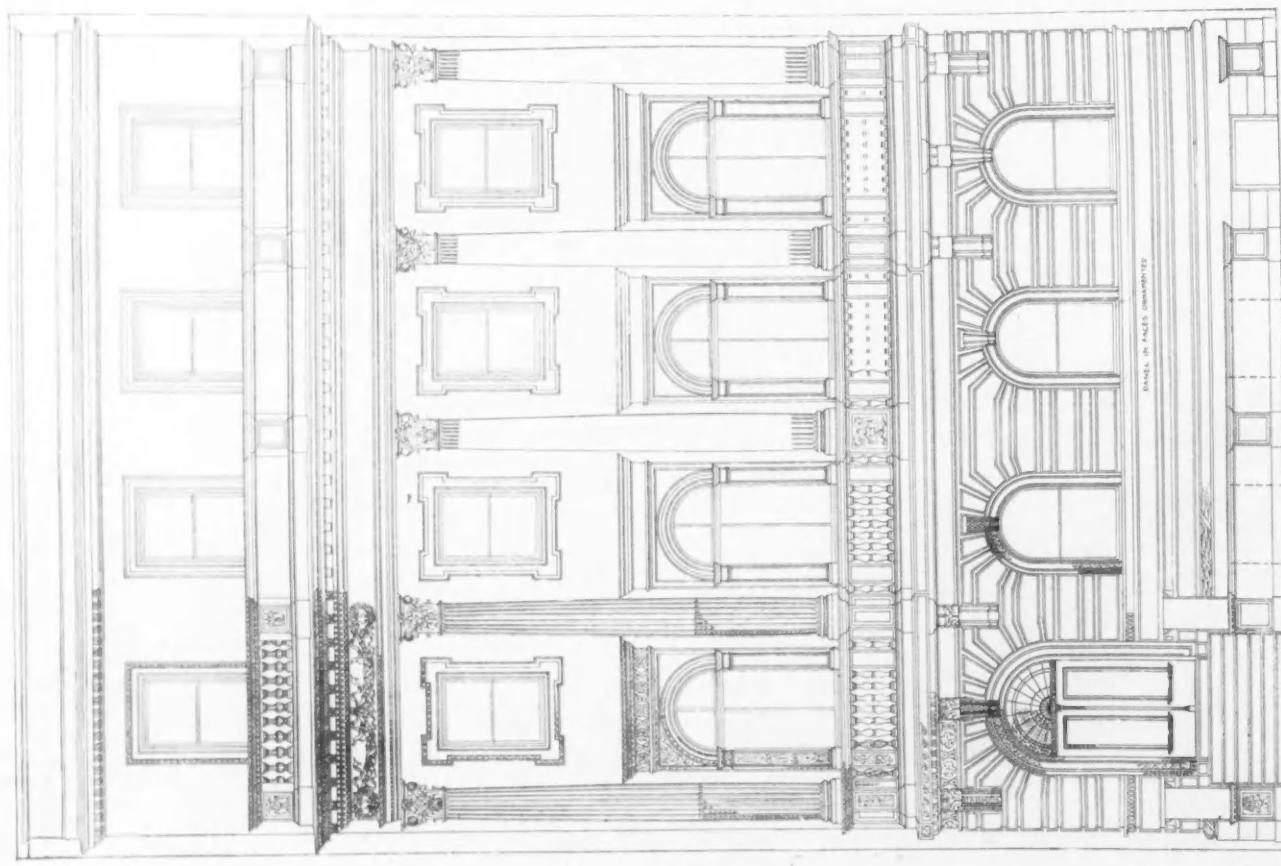


PLATE IV. THE ART OF BUILDING AMONG THE ROMANS. SEE PAGE 152.

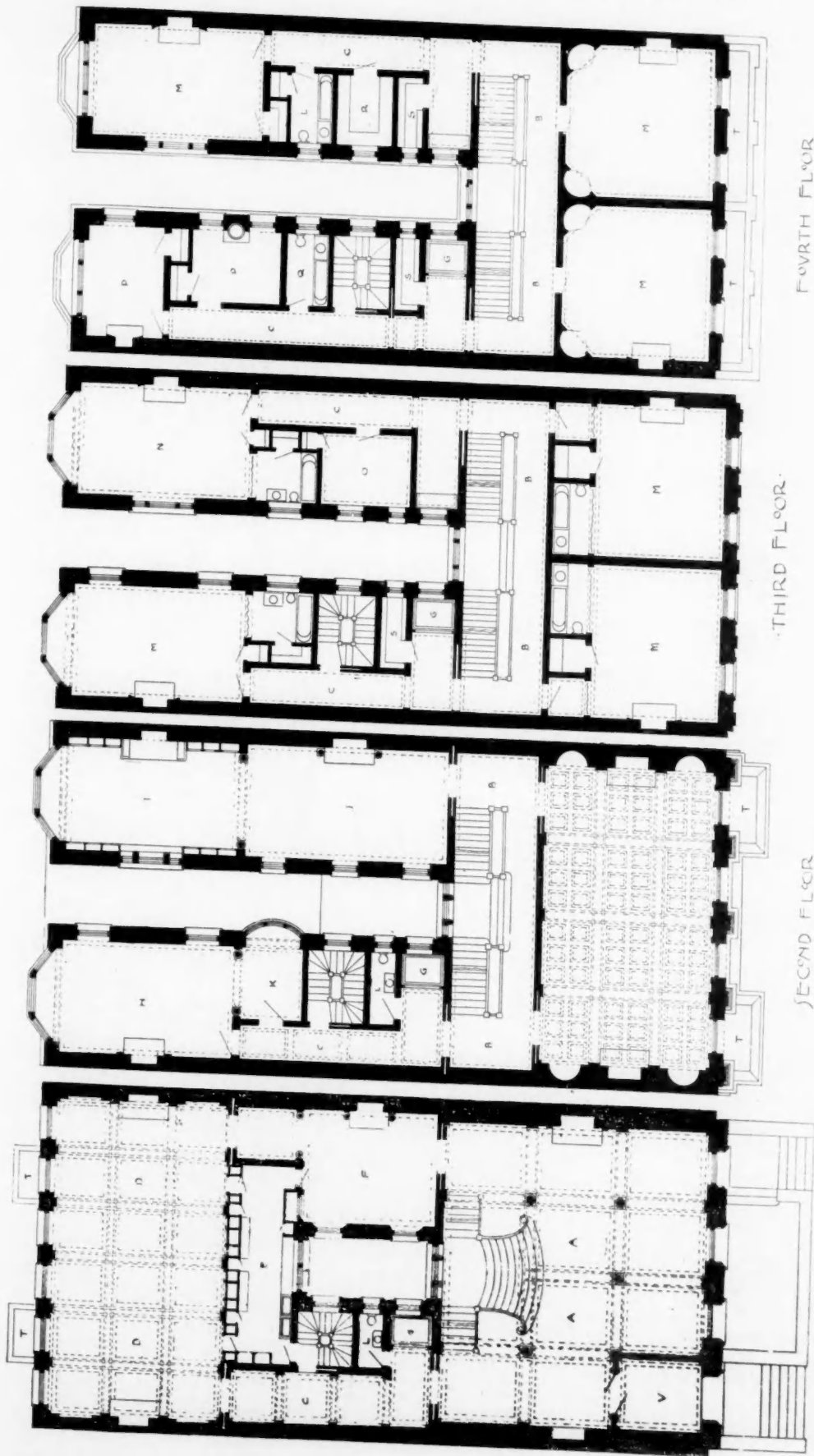


SIXTH PRIZE, J. MILLS PLATT, ROCHESTER, N. Y.



BRICKBUILDER COMPETITION FOR A CITY HOUSE.  
Elevations at one eighth inch scale.

FIFTH PRIZE, EDWIN R. CLARK, LOWELL, MASS.



FIRST FLOOR

SECOND FLOOR

THIRD FLOOR

FOURTH FLOOR

## BRICKBUILDER COMPETITION FOR A CITY HOUSE.

FIFTH PRIZE, EDWIN R. CLARK, LOWELL, MASS.

The first floor arrangement consists of vestibule, V; reception hall, A; grand dining room, D; pantry, E, and breakfast room, F. In dividing for two houses, the changes consist of a centre partition through hall, dining room and pantry; the addition of another vestibule and front entrance in the opposite corresponding bay, and changing breakfast room F, into a staircase, etc., similar to other side.

The second floor contains the drawing room, staircase hall, B; sitting room, H; library, I, and music room, J, with small conservatory at K. The library and music rooms together form a picture gallery. In dividing, a centre partition would be put through drawing room and staircase hall; also, service stairs, lavatory, etc., would be added, substantially as in other side.

The third floor consists of chambers, M, M, M, with small dressing or toilet rooms; a nursery, N, with bath; maid's room, O, and staircase hall, B. The changes necessary for dividing this floor are slight and obvious.

The fourth floor consists of chambers, M, M, M; servants rooms, P, P, and bath, Q; lavatory

Plans at a scale of one sixteenth of an inch.

at L; linen closets, S, S, and large store closet, R. The changes on this floor would be unimportant, and are quite obvious.

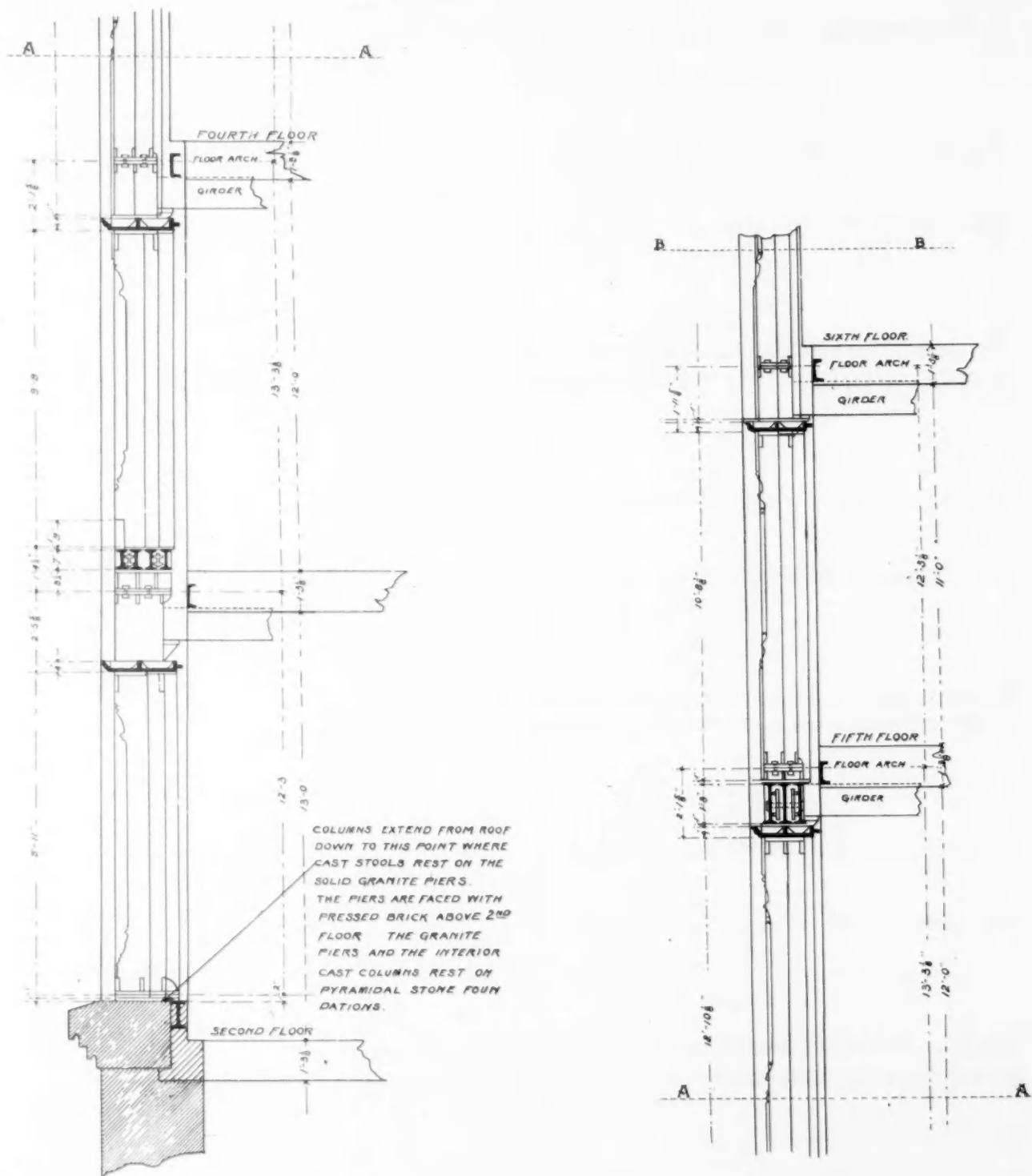
Balconies, T, are shown on the plans. The grand staircase and elevator, C, communicate with roof, which is intended for a summer garden.

The basement would contain a billiard room in front. In the rear, a kitchen, communicating with pantry above by staircase; also, small elevator, laundry and store room; also in the basement, cellar to contain heating apparatus and storage vaults.

I feel that some apology is due for the execution of the facade drawing, but lack of opportunity has prevented proper rendering of the drawing.

The materials are to be buff brick and white terra-cotta, the terra-cotta to be richly ornamented. The first store or basement portion of the facade to be rusticated; the courses to be terra-cotta, panelled, and the panels to be decorated.

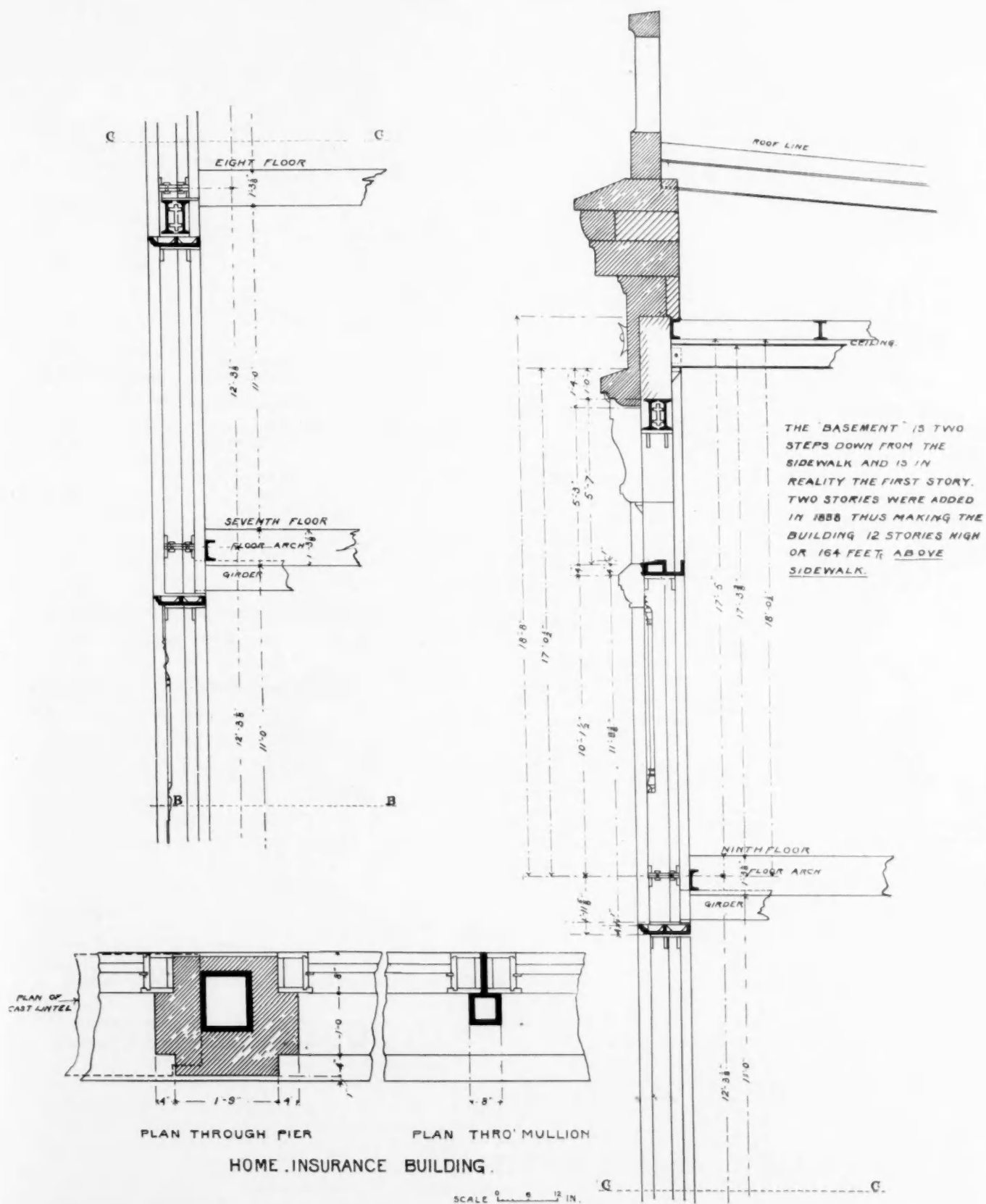




WALL SECTION SHOWING  
CONSTRUCTIONAL IRON WORK.  
**HOME INSURANCE BUILDING**  
CHICAGO.

SCALE 1" = 3' 11 1/2"

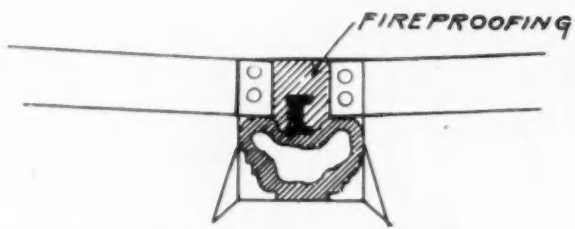
DETAILS OF FIREPROOF CONSTRUCTION. SEE DEPARTMENT ON PAGE 157.



HOME INSURANCE BUILDING

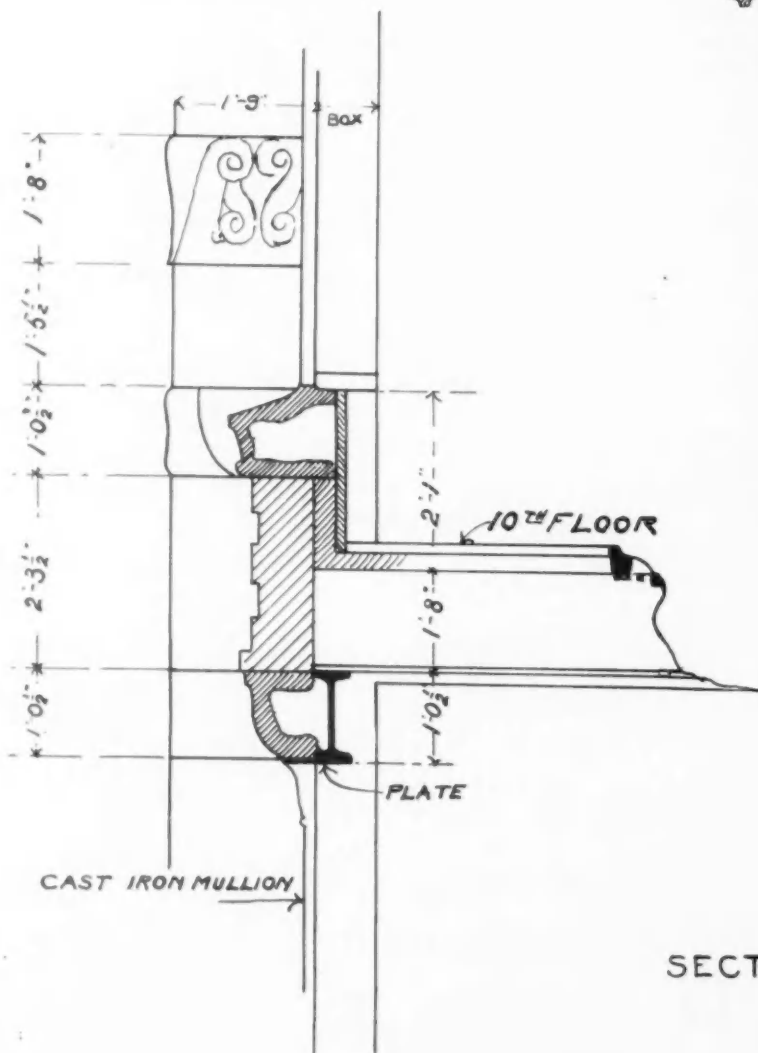
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DETAILS OF FIREPROOF CONSTRUCTION. SEE DEPARTMENT ON PAGE 157.



MULLION IN ORIELS

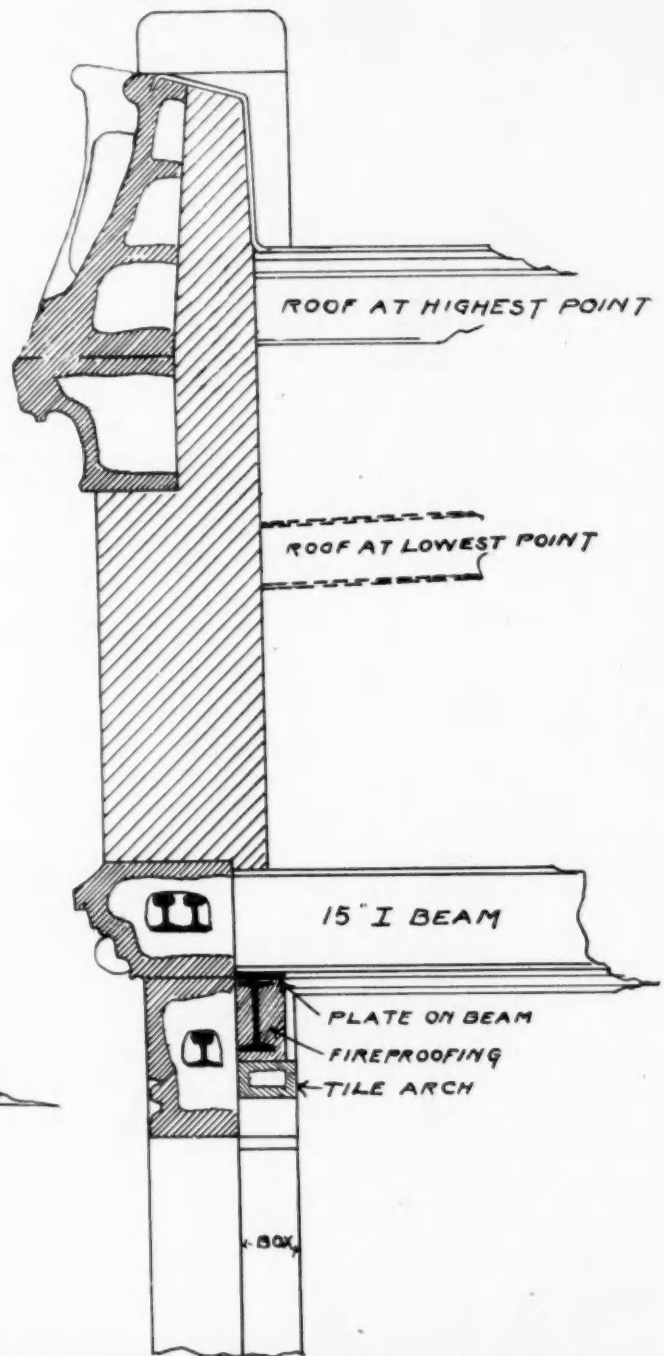
SCALE 0 6 12 IN.



SECTION THRO' FRONT WALLS.

## ROOKERY BUILDING

SCALE 0 6 12 IN.

SECTION THRO' FRONT WALLS  
ROOKERY BLDG.

DETAILS OF FIREPROOF CONSTRUCTION. SEE DEPARTMENT ON PAGE 157.



# THE BRICKBUILDER.

AN ILLUSTRATED MONTHLY DEVOTED TO THE ADVANCEMENT OF ARCHITECTURE IN MATERIALS OF CLAY.

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## PUBLISHERS' STATEMENT.

No person, firm, or corporation, interested directly or indirectly in the production or sale of building materials of any sort, has any connections, editorial or proprietary, with this publication.

THE loss of Mr. Arthur Rotch to the architectural profession is a serious one. It is seldom that there is found a man with large means, making constant effort, unnecessary as a factor of professional work, who remains as enthusiastic, as earnest, and as devoted to the welfare of his profession as has Mr. Rotch. From the time of his return from his studies abroad he has constantly endeavored to further all ideas that tended to architectural advance in this country. In his association with the Committee on the Tarsney Bill, in his interest in public improvements, his instrumentality in founding the first American Travelling Scholarship, he has been a very definite power towards intelligent and most satisfactory advance in architecture. His advice, which has been often asked, has always been carefully considered, and of value when given, and in many ways which have only been seen by his associates and not by the public, the sincerity of his interest in his profession has often been shown. His bequests serve as evidence of his character. They could not have been bestowed to better purpose.

IT is certainly to be regretted that there is a tendency among some manufacturers of brick and fireproofing terra-cotta to frequently cut prices in order to underbid a competitor, to that extent that not only is it apparent that all profit has been sacrificed, but the actual cost of manufacture is not obtained.

While it must be admitted that in times when business is generally stagnant the tendency of prices is downward, such conditions do not, however, offer a reasonable excuse for the present demoralized condition of prices on these materials.

If a certain manufacturer or number of manufacturers persist in sacrificing profit and cost in making estimates, the remedy is not in following such examples, but rather leaving them to their own methods, the evils of which may be counted upon to supply the remedy.

The natural advantages that these materials have over others, in the matter of cost and necessity, confine the responsibility of this unhealthy competition almost wholly to the manufacturer or his agent, although it must be admitted that there are cases where an architect will resort to the unprofessional-like

and dishonest methods to which we refer editorially in the July issue.

We believe that competition should be regulated by the elements that enter into manufacture, and in this respect certain economic questions play a very important part.

Unquestionably a concern that is well managed and that has sufficient capital to carry on its business, whose plant is well located as regards transportation, and the raw material used, has an advantage in the market when the two most essential requisites, cost and quality, are considered over one in whom these elements of strength are lacking, and yet it is principally because of the "bucking" between those two classes that the present ruinous prices prevail.

We do not wish it understood that this applies to all manufacturers of these materials; on the contrary, we know of many who, regardless of the demoralizing influences with which their market is beset, have continued to conduct business on business principles, and who are found to-day making the least fuss about "hard times."

We commend such to those who are sapping this splendid business of its vitality; for to follow the strong is to be strong, and to follow the weak is to be weak.

WE take pleasure in announcing an arrangement with the Hydraulic Press Brick Company of St. Louis whereby a full-page advertisement will be published for a year, under our direction. It is the aim of the company, or really the combination of companies (for there are now many offshoots from the parent concern in St. Louis) to present something in their space that will be of intrinsic value to the architectural readers of THE BRICKBUILDER, and do their share towards the artistic advancement of brick architecture in this country. Accordingly they have asked us to design a decorative border for their page, into which will be worked the addresses of the several companies, thus forming what there is in the way of an advertisement. Within this border we shall publish each month, at their expense, some photographic reproduction of foreign brickwork that we consider of value as a suggestion to American architects. We cannot too highly commend this kind of advertising, and we believe it will be fully appreciated by our architectural readers, and prove the strongest possible advertisement. In the selection of subjects we will certainly do our best to meet our advertiser halfway in this improvement in the paper.

HENDRICKS' Architects' and Builders' Guide and Contractors' Directory of America has made its annual appearance, and is unquestionably the most complete and best compiled work of the sort ever issued in this country. Its list of architects numbers five thousand one hundred and thirty-four, and is pretty nearly correct, though there is a number of errors in spelling and initials, which in some cases has caused duplication, the name being entered under right and wrong spelling. It is accurate enough for all purposes of circular addressing. The directory contains considerable advertising, largely on colored inserts, and much of it put in to reach architects; though why this medium should be used for the one purpose it is probably least useful, we cannot see. We have never come across a single instance of an architect using this directory, though in the building trades it is constantly used.

A TRADE journal with a thousand subscribers often has a greater number of readers of the sort the advertiser wishes to appeal to than the daily paper circulating a hundred thousand copies. — *Printer's Ink*.


MR. J. C. Anderson, the well-known brick manufacturer, has adapted his double-tunnel brick kiln for the cremation of garbage, which is loaded on cars and passed through the kiln. The firing is done by oil, and an ingenious device in the shape of an air poker is used to stir up and fully consume the garbage. This poker consists of a long tube having flexible connection with an air pump, so that fresh air can be blown with great force into the midst of the burning garbage, thus immensely aiding complete combustion.

MESSRS Hazelhurst & Huckel of Philadelphia have given the best examples of their work publication in an attractive book, bound in white and gold. The buildings of interest in a brick and terra cotta line are many, among them being a large city residence in the Renaissance style on Locust and Sixteenth Streets, for Mr. Daniel Baugh; the bricks for this residence were furnished by the Eastern Hydraulic-Press Brick Company. The Odd Fellows' Temple on Broad and Cherry Streets is a fine structure, in which the same company placed a buff Roman brick. A second house on Locust and Sixteenth Streets is also shown, which possesses special interest as brickwork. The other buildings illustrated are a fine factory building on Fifth and Cherry Streets, a twenty-five foot residence on Locust Street, and a residence on Sixteenth Street, near Oxford.

A NEW journal in the construction and material field has just come to hand. It is *The Monument, Sculptor, and Decorator*, published in the interests of workers and dealers in granite, marble, clay, terra-cotta, bronze, plaster, cement, and composition. It is of small value to architects, judging from its initial number, though to gravestone makers it is probably satisfactory. We wish, however, if it is going to publish statues in the nude, it would exercise more discrimination in the selection of subjects. The nude is not necessarily always artistic, and the two full-page cuts show very commonplace sculpture in this line.

WE have one criticism to make on the new department of ceramics and clayworking at the Ohio State University; it is installed in a rock-faced random ashlar building of sandstone. Perhaps we should be thankful for the course and not ask for too much; but we hope the day is not far distant when the increase

in scholars will make it necessary to erect a new building, which should be, architecturally, a model of brick and terra-cotta design and construction.

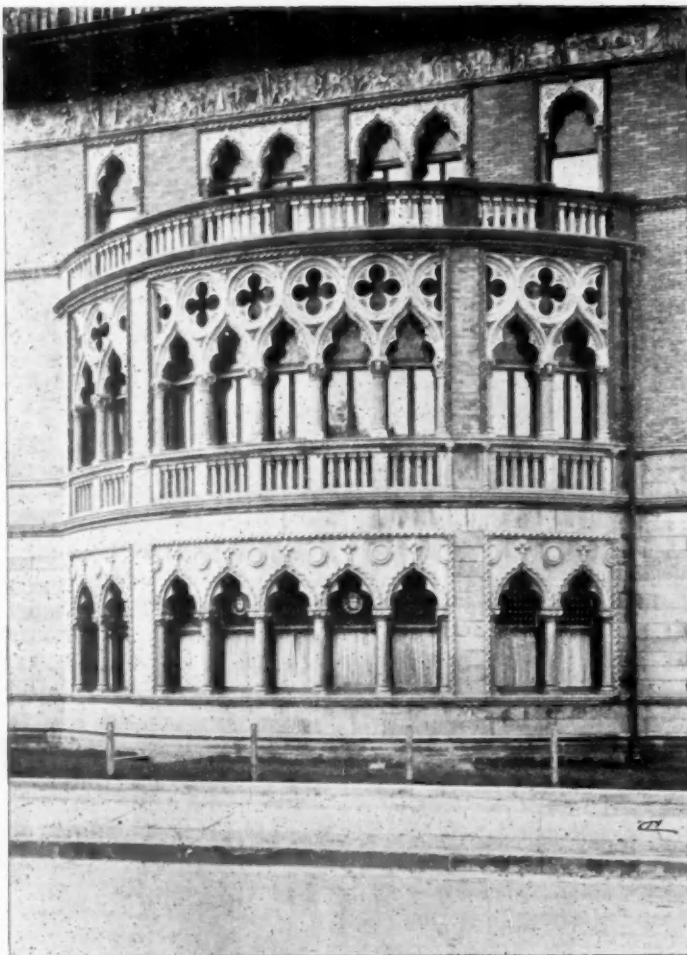
*BRICK*, a new monthly devoted to clayworking, contains a description of wall construction in India, which is interesting, though we question its value over the regular form of concrete construction. The wall is faced with tiles, which are made L shape in section. The wall is started by laying upon the levelled-off foundation an outside and inside course of tile, placed thus, . The space between is filled with concrete up to the top of the tiles, and a second course of tiles is similarly laid which is also filled with concrete, and so on, as high as the wall is to be built. One flange of the tile thus serves as a facing, and also as a form to hold the concrete, while the other flange, imbedded in the concrete, holds the facing with fair security.

MR. C. H. Peters, Government architect at the Hague, Holland, is engaged in an exhaustive study of ancient brick architecture in Europe. None of the results of his research have, so far as we know, been given to the public, even in the shape of papers read before societies. We expect, however, that the work will be published in book form when completed.

*BRICK*, Windsor & Kenfield's new monthly, publishes in its initial number an instructive parallel in railway culverts, one of stone, the other brick. These were built by the Chicago, Milwaukee & St. Paul, R. R. Co. In remarking upon the two forms of construction, *Brick* says: "No derricks are necessary; all the material is easily carried, and delivered at the required spot by unloading from the car, in chutes; the stone coping, which only serves as a roof to cover the top joints of brickwork, is light enough to be laid by hand. The brick construction is safer and can be built in less time than one of stone. Its first cost is lower, it is more durable, and good brick can generally be procured sufficiently near the work to make long shipments unnecessary."

It seems on first consideration as though this was so true that railroad engineers who have been constructing expensive stone culverts have been going to needless expense. If there is any reason why stone is better than brick we would like to have it brought to our attention.

NEXT month an exceptionally interesting number in point of illustration will be published, the cloister of San Zenone at Verona being a special feature.



DETAIL OF THE MONTAUK CLUB, BROOKLYN, N. Y.

F. H. KIMBALL, ARCHITECT, 55 BROADWAY, NEW YORK. TERRA-COTTA BY THE NEW YORK ARCHITECTURAL TERRA-COTTA COMPANY.

# THE BRICKBUILDER.

## FIREPROOFING.

157

A Department Conducted in the Interests of Building Construction to Prevent Loss by Fire.

### A HISTORY OF STEEL SKELETON CONSTRUCTION.

(See Plates 62, 63, and 64.)

#### THE PIONEER OFFICE BUILDINGS OF "CHICAGO CONSTRUCTION."

PREVIOUS articles have illustrated the wall construction of some of the latest office buildings. This month is presented a sketch of the beginnings of the "skeleton," or what is known as "Chicago construction."

For the development of every great departure in art or science, several minds seem to have been working simultaneously on the same originating idea. No one knows who originated any particular style in architecture. Each was a growth, the products of many minds. So to a certain extent was it with the development of the construction of the modern office building. Many architects have contributed hard work and fruitful thought to such effect that one can look at the latest building and scarcely know what ideas were his own and what he borrowed from his co-laborers.

The first ten-story building in Chicago, one to rear its head one or two stories higher than its predecessors, was the Montauk, built in 1881, corner Monroe and Dearborn Streets, Burnham & Root, architects. The walls of this building were of the regular masonry construction, faced with pressed brick, arches over the windows, iron beams carrying brick floor arches. The contribution here to the future office building was in the foundations. It was undoubtedly the first case where steel or iron rails were used for foundations. Most of the foundations of the Montauk were of the isolated pyramidal stone type. But these where they would have interfered with the boiler plant were omitted, and low platform foundations made of rails were substituted. Gen. Sooy Smith was consulting engineer when these foundations were devised.

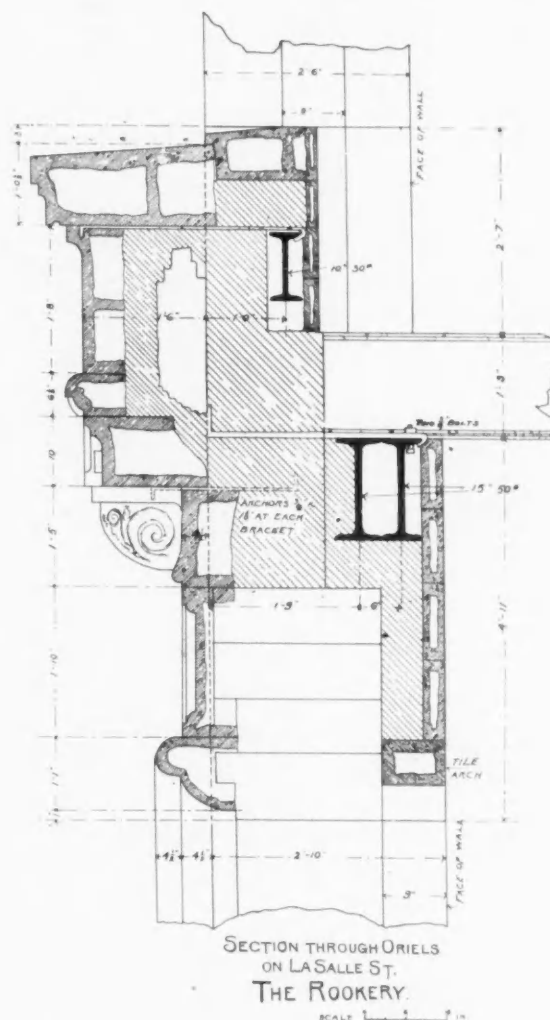
In conversation with the writer, Mr. D. H. Burnham has said that the credit of inventing the isolated foundation belongs to Mr. P. B. Wight, who used them to replace faulty foundations under the American Express Company's Building on Monroe Street, H. H. Richardson, architect. The invention and wide use of steel foundations should be accredited to Messrs. Burnham & Root.

The cantilever idea for foundations of party walls, another important feature of "Chicago construction," was Mr. Burnham's own idea, and was used first in the Rand-McNally Building, which followed closely, in point of time, the Home Insurance and Rookery buildings.

"But the skeleton construction," remarked Mr. Burnham, "that belongs to Mr. Jenney."

The first building to embody the "skeleton construction" idea, that is, in which the metal framework supported the floors, and even the masonry covering, was the Home Insurance Building, corner of La Salle and Adams Streets.

In the fall of 1883, W. L. B. Jenney of Chicago was appointed architect for the Home Insurance Company of New York City, and instructed to prepare designs for a tall, fireproof office building to be located on the northeast corner of Adams and La Salle Streets, Chicago, and to be known as the Home Insurance Building. The instructions required that the plans above the second story should provide for the maximum number of well-lighted small offices. The instructions further stated that the Building Committee were aware that this would necessitate very small piers, smaller probably than were admissible if of ordinary masonry construction, except perhaps in the upper stories. The architect was requested to report to the Building Committee the method of construction that would satisfy the requirements for stability and for small piers.



It naturally followed that if brick or stone was insufficient to carry the loads on the piers, a material must be provided that would support a greater load per unit of section.

Architects had often been obliged to build an iron column into a masonry pier where the load was exceptionally excessive. Mr. Jenney had done the same thing, building iron columns into two or more of the small piers in street front of the Fletcher and Sharp Building in Indianapolis some years before.

The natural solution of the problem was to enclose an iron column within the small masonry pier, thus satisfying the three requirements, a small pier, strong, and fireproof.

The question of expansion and contraction of a column one hundred and fifty feet high under the extreme variation of temperature, say 130° Fahr. or more, from the hot sun in summer to excessive cold nights in winter, now presented itself. A solution was soon found by the architect in supporting the walls and floors of each story independently on the columns, thus dividing the total movement into as many parts as there were stories, the expansion and contraction in no one being of sufficient importance to require special consideration.

The drawings were now prepared, and the first design for a



fireproofed skeleton construction was presented to the Building Committee of the Home Insurance Company for their acceptance.

As business men they naturally inquired, "Where is there such a building?" The architect replied, "Your building at Chicago will be the first." This naturally suggested to the company the very important question, "How do we know that it is good?" The architect proposed to submit his designs and calculations to one or more bridge engineers of distinction as the company might select; the design for the skeleton building resembling in many respects an iron railroad bridge standing on end.

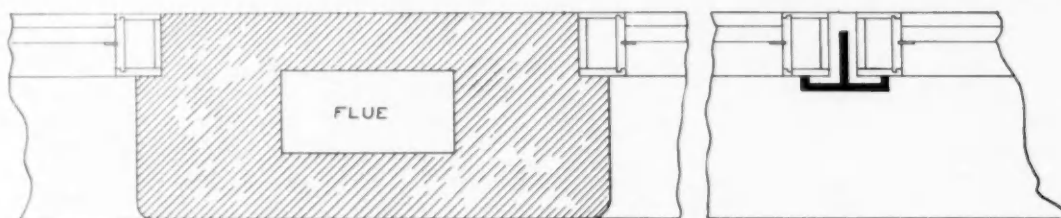
At this juncture Gen. A. C. Ducat, one of the managers of the Western Department of the Home Insurance Company, claiming the floor and the privilege of making a speech, stated that he had been an engineer before he became an insurance man, and that he had carefully studied the designs and the data for the calculations as presented by Mr. Jenney, and that they met his approval both constructively and economically, and that he would respectfully suggest that they be adopted, and that the building be commenced at the earliest date practicable. The motion was offered, seconded, and carried unanimously, and the building commenced.

Mr. Jenney has often stated that the question of applying for a patent occurred to him at the outset, but inasmuch as the first drawings for this skeleton construction seemed to him to be making general over an entire building what had been done before in a single pier, he did not think that the patent could be successfully defended if attacked. Still he regrets not having made the application, as it would have established conclusively his priority.

The columns in the Home Insurance Building were cast-iron. The riveted columns of plates and angles and other forms were at that time thought too expensive. It was in this building that the first Bessemer steel beams were used, manufactured by the Carnegie Phipps Company, who stated at the time that the Home Insurance Building was the first in the United States to use steel beams in its construction. These were only advance samples, however, of the new Bessemer steel beams. The great majority of beams in this building were iron.

In completing the details of construction, the assembling of the parts, wind bracing, etc., it was found necessary to invent special arrangements, the iron railroad bridge being the only precedent.

Since the Home Insurance Building, the most important improve-



PLAN OF PIER

ROOKERY BUILDING

PLAN THRO' MULLION

SCALE 1/4" = 1' IN.

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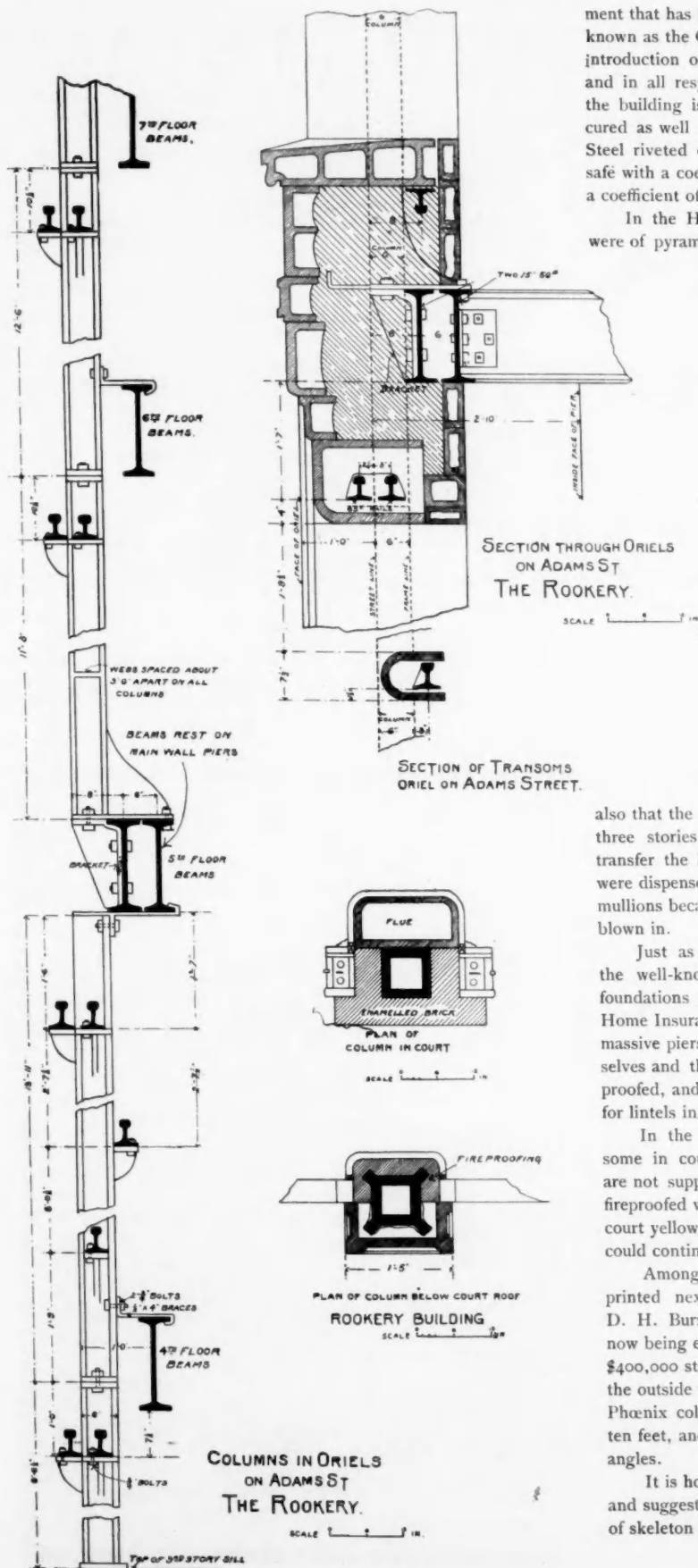
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ment that has been made in this class of construction, now generally known as the Chicago construction, or the steel construction, was the introduction of steel riveted columns, which are now made cheaply, and in all respects thoroughly satisfactory. All the assembling at the building is done with hot steel rivets; increased rigidity is secured as well as a material reduction in the weight of the columns. Steel riveted columns as now manufactured are considered perfectly safe with a coefficient of safety of four, while for the cast-iron columns a coefficient of safety of eight is not considered too great.

In the Home Insurance Building the foundations below ground were of pyramidal masonry (being in this respect a step behind the Montauk), dimension and rubble stone resting on a thick bed of concrete, each column exterior and interior in the basement having its own independent foundation. The footings on the clay were loaded uniformly per square foot throughout the building. The soil being compressible, it was necessary to use great care in calculating the dead loads and the actual live loads that would obtain in order to secure as near as practicable absolute uniformity of load per square foot on the clay throughout the entire building.

The success in this respect was demonstrated by the very uniform settlement. The maximum variation throughout the building at the end of a year was found by the most careful levelling by an engineer to be a little less than three quarters of an inch, while the total settlement was more than three inches. This total settlement was fully anticipated, and the building was started some four inches above grade to allow for this settlement.

By reference to the illustration showing framing in outside walls, it will be seen that for the two street fronts solid granite piers were used two stories high, and the columns began on top of these. Note also that the mullions are cast columns, carrying cast lintels through three stories to a point where heavy lintel beams are inserted to transfer the load to the pier columns. In later buildings cast lintels were dispensed with, lintel beams were placed at each story, and the mullions became only stiffening angles to prevent windows from being blown in.

Just as the Home Insurance Building approached completion, the well-known Rookery (Burnham & Root, architects) began its foundations just across the street. A number of advances on the Home Insurance are here recorded, although in the main street fronts massive piers instead of encased columns were used to support themselves and the floors. Rail foundations were used, lintels were fireproofed, and many details were well studied, although the use of rails for lintels in places seems now rather clumsy.

In the Home Insurance Building mullions and other columns, some in court walls, were exposed. In the Rookery the mullions are not supporting members, and almost all beams and columns are fireproofed with hollow tile, enamelled brick, or terra-cotta. In the court yellow glazed terra-cotta lintels and sills were used. Thus one could continue to trace development from building to building.

Among the illustrations presented are details (which will be printed next month, and for which acknowledgment is made to D. H. Burnham & Co.) of the Reliance, a fourteen-story building now being erected in Chicago. Details are shown also of a four-story \$400,000 stable erected for the American Express Company. In this the outside walls support themselves only. The floors are carried on Phoenix columns. The tile floor arches are five inches thick, span ten feet, and rest on long span twenty-inch beams built of plates and angles.

It is hoped that these details will prove valuable for comparison, and suggestive to those who are interested in the further development of skeleton construction.

D. EVERETT WAID.

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# MORTARS AND CEMENTS.

A Department devoted to Advanced Methods of using Cements and Limes in Building Construction.

A REVIEW OF VARIOUS METHODS OF CONCRETE CONSTRUCTION AS APPLIED IN ENGINEERING WORKS.

A COMPARISON OF THE COMPOSITION OF VARIOUS CEMENTS ARRANGED WITH A VIEW OF DETERMINING THEIR RELATIVE VALUES IN CONSTRUCTION.

IT is proposed in the present paper to go somewhat into the detail of the composition of various cements, inasmuch as the constructive values of cements depends very largely upon the amount of variation in the proportion of the various elements that compose them; and it will be of interest to show the manner in which we may progress in the formation of cements from their simplest form as they exist in lime mortar to the complex hardening of the best Portlands.

As has already been shown in a preceding paper, the hardening of cement is due to a chemical union between two and often three primary substances, — lime, silica, and alumina, — and as far as the formation of concrete is concerned it is of no consequence whether this union takes place in a few hours or continues slowly through hundreds of years: the result is the same. We may therefore begin with

## LIME MORTAR,

which, though not ordinarily called a cement, inasmuch as it shows none of the qualities belonging to a real cement, within ordinary limits of time, still a union of its elements is gradually taking place and ultimately will result in a hard compound in all respects similar to a cement. The length of time required to bring this about depends on the quality of the sand used in making the mortar; and with ordinary sand, which contains little soluble silica, the process may continue for centuries, while with pozzolanas, which are rich in soluble silica, the hardening is of sufficient quickness to warrant the use of these mortars in damp localities and even under water. Inasmuch, however, as the hardening of ordinary lime mortar is due entirely, as far as practical results are concerned, to the absorption of carbonic oxide from the air, we will consider at present only that form of lime mortar which shows distinct setting properties, namely: that made of pozzolana and those remarkable sands used so extensively in the buildings of Rome.

The mortars made of these peculiar sands are veritable lime mortars as far as the simple mechanical mixture of lime and sand is concerned; but they possess, in addition, all the qualities belonging to a real cement.

## POZZOLANA, SANTORIN EARTH, TRASS, ETC.

These are the various names used to designate a peculiar sand which has the property of uniting immediately with nascent lime to form cement. They are variable in quality, some being more adapted to use in wet localities than others. The santorin earths are especially noted for their power of conferring hydraulicity upon fat limes,

while trass has been extensively used in Holland in submarine works of importance. A comparison of the elements of these pozzolanas will demonstrate the variation in the proportion of silica, those possessing the lowest amount of silica being the least adapted to hydraulic work.

	Pozzolana, Rome.	Santorin Earth.	Trass.
Silica.....	48	69	51
Alumina.....	14.3	15	16
Magnesia.....	3.9	2	5
Oxide of Iron.....	10	4.5	5
Lime.....	7.7	2	10
Alkalies.....	4	8	13
Sand.....	3	.....	.....
Water.....	9.1	.....	.....

Nascent lime is obtained by the calcining of lime rock, the fresh burned lime being immediately slaked and mixed with the pozzolana sands. The union that takes place is precisely the same one that occurs when Portland cement is wet, namely, the formation of a complex double silicate of lime and alumina. So that in the making of concrete the ultimate results are similar, whichever process be used.

It is interesting in this connection to note the latest and one of the most clever and economical applications of this fundamental principle of cement making, as shown in the manufacture of

## BRICK AND ARTIFICIAL STONE

by Mr. E. L. Ransome, the well-known cement expert.

The process consists first of making a sand containing a large proportion of soluble silica. This is accomplished by burning out the combustible material in ashes and waste products, and at a high temperature converting the mineral base of these materials into hard silicious slag,—a veritable pozzolana. The combustible materials are converted into fuel gas and used in various operations about the works. Second, nascent lime is produced by burning lime rock either in the same furnace or independently, and the slag and nascent lime



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are then ground together and pressed into bricks or other moulded forms. The brick are then placed under water, the indurating proceeds indefinitely, and the product is a concrete of great strength and durability. The wonderful economy of the whole process, the conversion of waste material into building stone, is a great step forward in economics, and no less interesting is the fact that this is the same old Roman principle developed and refined in the light of modern science.

#### ROMAN CEMENT, HYDRAULIC LIME, AND ROSENDALES.

We have up to this point discussed a class of cements which are formed during the process of making the concrete, and which had no distinguishing qualities as cements until their component parts were brought together in the mortar that formed the matrix of the concrete. We come now to a second division, which includes cements proper,—those which have an individual existence as cements, and are used as such. These are of two kinds, the natural and the artificial. Under natural cements we include a large field,—all so-called Roman cements as used in England, all hydraulic limes as found in France, Belgium, and the shores of the Mediterranean, and the Rosendales, which have such extended use in America.

These cements are composed of the same elements united in varying proportions. The cement rock is calcined and finely ground, and the product when mixed with water sets, and acquires a considerable degree of hardness. It is obvious that the value of these natural cements depends, first, upon the proportion of the elements of which they are composed; and, second, upon the uniformity of this proportion: for the first gives the cement its strength and its construction value, while the second insures the confidence of its users. It is also obvious that disregarding the process by which the cement is produced, there is great chance for variation in the composition of cement rock, and it is this continual variation that makes all natural cements assume a secondary position, aside from the fact that few of them attain the perfection in strength, conformity, and color that characterizes the real Portlands; and the fact that a cement is a natural cement marks that brand at once as one that must be used with caution.

The Roman cement was used very extensively at the close of the last century, before the development of the Portlands. It is made from nodules found in London clay, and consists of a dark colored aluminous limestone, with a composition of from 60 per cent to 70 per cent calcium carbonate, 18 per cent to 20 per cent silica, and 6 per cent to 10 per cent of alumina. These proportions are variable, however. The cement is light in weight, quick setting, and deteriorates rapidly after manufacture, nor does it acquire great hardness.

The hydraulic limes, especially the Chaux de Theil, find extensive use in France, Belgium, and along the shores of the Mediterranean, large quantities being used in the construction of the Suez Canal and many important harbor works. These limes are similar in composition to our Rosendales, are moderately hydraulic, quick setting, and show the variation common to natural cements. It is true that some of these cements approach the high standard of the Portlands, and possess qualities that warrant their use in important works, but they should be watched carefully, constantly tested, and used with discretion.

Many brands of these natural cements assume the name "Portland," when in fact they have no claim to that title. It may be true that they often develop a strength equal to some Portlands, but even that does not entitle them to rank in that class. The natural cements possess certain characteristics that impose a limit upon their usefulness, and they must be content to be governed by those characteristics, for they can never hope to attain the perfection of the great German cements, and their claim to rank with them is a usurpation of distinction that they cannot defend. They have a wide range of usefulness, and the development of the process of manufacture will advance them as they deserve in the estimate of their users, but they must be content to stand upon their own ground and not try to borrow excellence by the assumption of a name.

The following table shows the variation of the ingredients in the

raw material used in the manufacture of Roman cement, hydraulic limes, and Rosendales, fat limes, etc.

	Carbonate of Lime.	Carbonate Magnesia.	Iron, Sand, etc. Alkalies, etc.	Water.	Silica.	Alumina.	
Fat Lime.....	100	.....	.....	.....	.....	.....	Carrara Marble.
Fat Lime.....	94.5	2.5	1.2	1.8	.....	.....	Oolite.
Poor Lime.....	79	3.7	12.4	4.2	.....	.....	Oolite.
Eminently Hydraulic Lime.	71.6	1.4	3	.5	20.1	3.5	English.
Eminently Hydraulic Lime.	65	1.5	8	.5	22.5	2.5	Chaux de Theil.
Slow Setting Cement	63	2.5	4.5	.....	24	6	English Portland (artificial).
Moderately Quick Setting	43.3	26	8.1	1.9	16	4.7	Rosendale.
Quick Setting...	54	14.2	15.9	3.7	8.8	3.4	Roman Cement.
Quick Setting...	65.7	.5	8.7	1.3	18	6.6	Roman Cement.
Quick Setting...	46	17.8	5.6	.7	22	8	Rosendale.

#### PORTLAND CEMENTS.

We come now to a class of cements which are so well known as to require little description. They are artificial cements, the product of scientific investigation, and the perfection of the principle underlying all cement hardening. By analysis and constant experiment, the exact proportions of lime, silica, and alumina necessary for the production of the most perfect union have been determined, and the mechanical processes for mixing, burning, and grinding, have been so perfected as to produce a cement the quality of which leaves nothing to be desired. They are, for all practical purposes, absolutely uniform in quality; the average composition of a good Portland is shown in the above table; they develop tremendous strength in concrete; they are economical, and may be used with large proportions of aggregates; they are invariable in color, and for hydraulic qualities have no rival. The German Portlands are the finest in the world in all respects, and an engineer may be at ease when his work is being done with these standard cements. The English Portlands are more variable, coarser ground, and less economical. The processes of manufacture differ widely in the two countries, and possibly the characteristics of the people of the two nations are shown in the results of their work.

The Portland cements of American manufacture have a long road to travel before reaching the standard of excellence achieved by our rivals across the water; but with the great quantities of material suitable for this work at hand, it is only a question of time when American ingenuity will devote itself to the production of a domestic cement of equal quality with any in the world. The writer is not aware of the existence of a cement plant in the United States in which the production is carried on precisely as in Europe, nor is the term "Portland" justly assumed by a great majority of American cements. It is doubtless true that several grades of domestic cement have attained a high standard and are suitable for use in important work, but they are few, and extraordinary care must be observed in their use, and every precaution taken to guard against the great bugbear,—variation,—for

until that is absolutely overcome, no cement can hope to take precedence of those excellent products which, by long and successful use, have proven themselves worthy of the highest regard, and which have won for themselves the first place in the confidence of professional builders.

ROSS F. TUCKER.

#### GOOD MORTARS.

THEIR COST, STRENGTH, AND DURABILITY; HOW TO MIX PROPERLY.

**P**ERHAPS the most important factor in the erection of brick or stone structures is the mortar; and it behooves every architect and builder, therefore, to know what is the best mortar and how to make it, that in the near future masonry may regain the prestige it once held, and be no longer known as "the lost art."

**Lime Mortar.** The calcination of statuary marble, or any other fine variety of limestone, produces quicklime, by expelling from the carbonate of lime of which it is composed the carbonic acid gas, water of crystallization, and organic coloring matter. Lime is, therefore, a protoxide of calcium, or, in other words, a metallic oxide. Pure lime has a specific gravity of 2.3, is amorphous, somewhat spongy, highly caustic, quite infusible, possesses great avidity for water, and if brought in contact with it will rapidly absorb twenty-two to twenty-three per cent of its weight, passing into the condition of hydrate of lime, in which condition it is said to be *slaked*. Lime, on account of its great affinity for moisture, and when moist for carbonic acid, absorbs them gradually from the atmosphere, and returns to the carbonate of lime. To protect it, therefore, from these deteriorating agents, it is necessary to preserve it in close vessels, and thus the best lime for use is the fresh burned.

The limestones which furnish the limes of commerce are seldom, if ever, pure, but usually contain, besides the carbonate of lime and water of crystallization, variable proportions, seldom exceeding ten per cent in the aggregate of some, if not all, of the following impurities: silica, alumina, magnesia, oxide of iron, and oxide of manganese, and sometimes traces of alkalis, the presence of which modifies, to a certain degree, the phenomena developed during the process of slaking, and renders necessary certain precautions in their manipulation and treatment when employed for the purposes of construction. The common fat or rich limes usually contain less than ten per cent of the impurities mentioned above. In slaking they augment to form two to three and one half times that of the original mass. They will not harden under water or even in damp localities excluded from the air, but in the air they harden by the gradual formation of carbonate of lime, due to the absorption of carbonic acid gas.

The pastes of fat lime shrink in hardening to such a degree that they cannot be employed as mortar without a large dose of sand. Paste of fat lime may be added to a cement mortar in quantities equal to that of the cement without material diminution of strength. The poor or meagre limes generally contain silica, alumina, magnesia, and other impurities in amounts seldom less than ten, or more than twenty-five, per cent of the whole. They dissolve in water frequently renewed, and are not adapted to be used under water or wet soil.

The hydraulic limes, including the three subdivisions of limes slightly hydraulic, hydraulic limes and limes eminently hydraulic, seldom contain an aggregate of impurities exceeding thirty-five per cent of the whole. They slake still slower than the meagre limes.

Air-slaked lime makes a poor mortar, and an excess of water in slaking (usually called drowning the lime) is also injurious.

The strength of all mortars depends to a much greater extent

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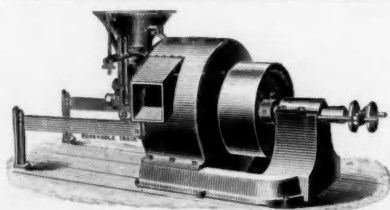
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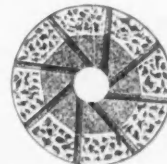
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We can grind from 70 to 75 bbls. Louisville Cement per hour with your Rock Emery Stones. This is from 10 to 15 bbls. more per hour than our ordinary stones will grind. Since May 3 have dressed these but twice. Ordinary Stones we dress every three days. Rock Emery Stones save us several dollars per week in dressing alone.

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than is generally supposed upon the thoroughness of the mixing. In ancient times some one with some conception of the manner in which lime and sand unite superintended the mixing, but nowadays builders imagine that any good laborer can make mortar properly.

The best mode of slaking, as far as regards the quality of the mortar, is by sprinkling the dry lime with a hose until the lime is in the form of putty, then cover with sand. The proportions of one measure of lime and five measures of sand is about the average used for common mortar by good builders in our principal cities, and if both materials are well mixed, the mortar is as good as can be required for ordinary purposes, and require no addition of hydraulic cement. The bulk of the mortar will usually exceed that of the dry sand about one eighth part. An excess of water in slaking the lime swells the mortar, which remains light and porous, or shrinks in drying; and an excess of sand destroys the cohesive properties of the whole mass.

The tenacity or cohesive strength of hardened good common lime mortar, according to careful trials and experiments by General Totten of the United States Army, with mortar only six months old, varies from 60 to 34 pounds per square inch, or from 864 to 4,896 pounds, or from .39 to 2.19 tons per square foot. About fifteen and a half pounds per inch is near this gentleman's experience, and is quite as high as can be safely risked in practice. It is true that his experience showed that at the end of four and a half years some of the mortars had acquired from two to three times greater strength, but others in that time increased but one third part. Moreover, in practice, the working strains are generally brought upon masonry by the time that some of its mortar is not more than six months old or even less; therefore, we cannot avail ourselves of the additional strength given by time, but if such increase is needed speedily, we must add cement.

The crushing force may be taken at fifty tons per square foot, or seven hundred and seventy-seven pounds per square inch.

The sliding resistance, or that which common mortar opposes to any force tending to make one course of masonry slide upon another, is stated by Rondelet to be but five pounds per square inch, or about one third tons per square foot in mortar six months old.

The adhesion to brick or stone may ordinarily be assumed to be at least equal to its cohesive strength in properly executed work.

There is risk in using common mortar in cold-weather. If the cold should continue long enough to allow the mortar to set well, the work may remain safe, but a warm day may occur between the freezing and the setting of the mortar. In that case the walls will always be weak, for mortar that has partially set while frozen, if then melted, will never regain its strength.

*The American Architect* asserts that adding salt to mortar in cold weather to preserve it from the bad effects of freezing has been found highly beneficial. Engineers and contractors who have tried it are unanimous in their praise of it. Many cases are seen where masonry has been laid in cement in cold weather, using salt in the mixture, which, after repeated freezing and thawing, has remained in perfect condition, while work near by, laid in mortar of the same kind, but without salt, has been disintegrated by the frost.

The cost of mortar varies in different localities according to the price of sand, lime, etc. The quantities and proportions only can be given, and the builder must figure the cost from these. With bricks of 8 x 4 x 2 inches, the following are the quantities of mortar as compared with the whole mass.

SIZE OF JOINT.	AMOUNT OF MORTAR IN WHOLE MASS.	NO. OF BRICK IN CUBIC YARD.	NO. OF BRICK IN CUBIC FEET.
$\frac{1}{8}$	$\frac{1}{8}$	638	23.63
$\frac{1}{4}$	$\frac{1}{4}$	574	21.26
$\frac{1}{2}$	$\frac{1}{2}$	522	19.33
$\frac{3}{4}$	$\frac{3}{4}$	475	17.60
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(Trautwine, C. E.)

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GUARANTEE.			
1 day in air, 6 days in water,	-	-	400 lbs. }
1 " " " 27 " " " "	-	-	500 " }
1 " " " 3 months in water	-	-	600 " }
3 parts of sand to 1 of cement.—Adhesive test.	-	-	-
1 day in air, 6 days in water,	-	-	125 lbs. }
1 " " " 27 " " " "	-	-	175 " }
FINENESS.			
Residue on sieve No. 50,	-	-	None.
" " " 100,	-	-	10 per cent.
Passing through sieve No. 200,	-	-	65 "
Every barrel guaranteed to stand the boiling test, the test for safety.			

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Guaranteed to stand all required tests.

115 Broadway, NEW YORK.



From the foregoing information the mason can easily calculate how much his mortar will cost per thousand bricks laid, or per cubic yard of stone.

In the next number we shall try to show the best mode of mixing and using cement mortar.

R. N. BUELL, New Britain, Conn.

#### DIRECTIONS FOR THE EMPLOYMENT OF PORTLAND CEMENT.

(FROM A PAMPHLET PUBLISHED BY E. THIELE, NEW YORK.)

THE results obtained from the employment of a good Portland cement depend in a great measure upon the correct observation of a few rules, here laid down, which those not experienced with Portland cement, and no matter how great their experience may be with natural cements, lime, etc., should study carefully.

#### GENERAL OBSERVATIONS.

Quick-setting cement should only be employed in cases where changes of tide, a sudden rush of water, very low temperature, or other causes may require it.

Slow-setting cement, such as the Dyckerhoff, is best adapted for most purposes. It permits an easy and thorough preparation of the mortar or concrete, and, possessing greater tensile strength than quick-setting cements, a larger proportion of sand can be added.

After the first hardening, slow-setting cements harden more rapidly and more intensely than quick-setting cements.

Portland cement is very seldom used neat or pure; nearly in every case sand is added for mortar, or sand and gravel, or sand and broken stone, for concrete, except for the plastering of cisterns, where neat cement is rubbed into the coat of plastering, to obtain the greatest impermeability.

The sand, gravel, and broken stone to be added to the Portland cement, as well as the water, must be perfectly clean, free from loamy or earthy substances, and the sand as sharp as possible.

Loamy sand should be cleaned by washing.

Soft stone and very fine sand should be avoided, or the finest particles removed by passing the sand through sieves.

Where cement is used for plastering brick or stone walls, the walls should be thoroughly cleaned, washed, and repeatedly sprinkled with water, which will prevent the dry stone or brick of the wall from absorbing the water in the cement, necessary for its hardening.

For the same reason, porous sandstone, bricks, etc., to be used in masonry, should be thoroughly soaked in water. Where extraordinary strength and durability are required, as in foundations for machinery, the stone or bricks should be allowed soaking under water for some time.

All cement work, cement plastering, artificial stone, etc., should be guarded against drying too rapidly.

## ATLAS PORTLAND CEMENT.

WARRANTED EQUAL TO ANY AND SUPERIOR TO MOST OF THE FOREIGN BRANDS.

OFFICIAL TESTS, Nos. 3567 and 3568, made by the DEPARTMENT OF DOCKS, New York, March 31, 1894, being part of contract No. 464 for 8,000 barrels.

TENSILE STRENGTH, 7 days, neat cement	622 lbs.
" " " 7 days, 2 parts sand to 1 of cement	332 lbs.
Parts steamed and boiled	Satisfactory.

All our product is of the first quality, and is the only American Portland Cement that meets the requirements of the U. S. Government and the New York Department of Docks. We make no second grade or so-called improved cement.

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If the cement is to obtain its maximum hardness, all such work should be kept moist for several weeks.

It is an error to suppose that any kind of sand or gravel will answer. Cement will not bind loamy sand or loam, and concrete made with such will not attain any density or hardness and will only result in the waste of the cement and labor.

#### PREPARATION OF PORTLAND CEMENT MORTAR.

Spread out the exactly measured quantity of sand, pour upon it the exact quantity of cement and mix the whole dry until it has an even color. Then add slowly by sprinkling the required quantity of water, while the material is being constantly and carefully stirred and worked up. Continue such mixing for some time and excellent mortar will result.

One to two parts of sand to one part of cement are only added in cases where unusual strength, great impermeability to water, or great resistance to wear are required.

Three to five parts of sand to one part of cement produce an excellent mortar for masonry, plastering, etc.

The addition of water for mortar should be greater with quick-setting than with slow-setting cements.

Mortar of slow-setting cement (such as the Dyckerhoff) prepared with just sufficient water to produce a stiff paste, produces the best work, and attains the greatest durability.

If too much water is added the hardening sets in very late, especially in damp and cold weather, and the work will become less dense and therefore less durable.

It will be the endeavor of the publishers to make this department of THE BRICKBUILDER the representative periodical of the Cement trade, and the cooperation of all importers and manufacturers is solicited.



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Cleveland, O.

#### A WHITE PORTLAND CEMENT.

A RECENT number of the *American Architect* contains the following editorial:—

"We have at this moment a call for some white Portland cement, and would be very glad if any of our readers could tell us where such cement can be procured. It is made in Germany, or, at least, a white Portland cement was, at one time, advertised in the German building papers; but we have never heard that any was imported, nor do we know that any is manufactured in this country. As Portland cement is made simply of lime and clay, there ought to be no difficulty in finding a clay which would burn white, and, by mixing this with white limestone, in producing a perfectly white Portland cement, having all the strength and other good qualities of the ordinary dark-colored cement. If such a material could be had, we think that there would be a large demand for it. The use of concretes, both for inside and outside work, is extending very rapidly in this country. For inside work, the disagreeable color of the Portland cements has been an insuperable objection to their use, and Keene's cement, a poor and weak material, according to modern ideas, has held its place against them; but Keene's cement is totally unfit for the paving, staircasing and protection of ironwork now required, and a thoroughly reliable cement, of a white, or very light, color, would be a most useful material."

THE attention of mason contractors is called to this department, on Mortars and Concretes. Writers of practical experience in the mason-contractor business have been engaged to write upon subjects which they consider of the most value to the largest number of those engaged in this business. Through these columns we will have inquiries as to the use of Mortars and Concretes, answered by specialists, with whom arrangements have been made for this very purpose.



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Our New Colors are novel and attractive and well worthy of attention.  
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# THE MANUFACTURER.

A Department devoted to the Market Side of Clay Production.

## ROMAN-SHAPE COMMON BRICK.

AND OTHER MATTERS FOR THE MAKER OF COMMON BRICK  
TO CONSIDER.

JUDGING from the many letters received in time for publication in our last issue and almost as many more of the same tenor received since, there is a field for manufacturers who will make a good common brick, Roman shape. Such a brick would not be used for common construction where no effect of wall surface was desired, but for a front brick in places where the regular and more expensive pressed brick cannot be used. In country work particularly, when the high finish of pressed brick is not desirable, the rougher common brick, varying in shade and made Roman shape, would find many uses. We consider the correspondence published last month, coming from almost every section of the country, a sure sign that there is a market for this class of brick. Some of the architects writing favorably have large enough practice to support a brick manufacturer, and if approached by him with a proposition to get out such stock, would undoubtedly guarantee him large enough orders to make it worth while to put in a machine that would produce the Roman shape brick.

It is a matter in which we are deeply interested; and now that so many of our architectural readers have come out with no uncertain expression, we hope to see our manufacturing readers meet them half way. There is no way in which THE BRICKBUILDER can be of more direct value to the brickmaking industry than by thus bringing the producer and consumer together.

It has been a matter of disappointment that so few manufacturers have had anything to say. They have not even signified any willingness to consider the question. Of the several letters we did receive, only one, that from the Kensington Brick Company of Pittsburgh, gave any evidence of progressive spirit. This one exception we commend to our architectural readers as showing the proper spirit.

One manufacturer stated there was no market in his section, and yet a firm of architects in his own town, who have unquestionably the largest practice in that locality, express themselves ready to use such a brick in large quantities, and stated that they had often wanted just this thing but could not get it.

We hope to hear the manufacturers' side more fully before our next number.

Another question that has often been put to us by architects is where a moulded common brick can be had. There is no reason why any common brick machine cannot be fitted with the simpler forms of moulding, such as the cyma and ogee, and certainly in the case of hand-made bricks, the difficulty of making these patterns is inappreciable. They would have to be handled more carefully, but then they are not sold by the wagonload, and the extra price they would

bring would more than pay for the extra care necessary in handling them in manufacture and delivery.

These are by no means idle or impracticable speculations. In this department we advance no ideas for manufacturers to consider that are not first suggested by the very parties most concerned, *i. e.*, the buyers and consumers.

In every branch of trade the production is governed by the market. Whatever will sell will be made. Our architectural subscribers, now comprising a large majority of the architects in the United States, take THE BRICKBUILDER because it covers one special field. When they want information on brickwork they consult it as the most reasonable place to get the information. If its articles or advertisements do not give them what they want to know, a letter to the editor naturally follows, for he certainly, if any one, is in a position to at least secure the wanted information. It is in this way that ideas come to us and are presented in this department.

In the case of moulded common brick, the first inquiry came from Cook, Hapgood & Co., architects, of Hartford, Conn., who really wanted to use such brick in work they then had under construction. Besides making an inquiry in our columns, and sending marked copies to over one thousand manufacturers of common brick, we had letters written directly to over three hundred brickmakers in an honest endeavor, not to help some manufacturer sell his bricks, but because we considered it our duty to spare no trouble or expense in getting information in our field that we knew a subscriber really wanted and had every right to expect of us. Not a single favorable reply was received. Since that first inquiry a dozen or more have been received. This indicates a demand for the article that is not a whim of one man, and no enterprising manufacturer can afford to wholly ignore it.

THE BRICKBUILDER goes to architects and builders, who take it for the sole reason that it is an assistance to them in their use of brick and terra-cotta. If certain architects whose work is known by reputation throughout the country find a certain shade of brick, or a certain style of detail effective and use it successfully, the illustration of it leads other architects to also try it, and so the "fad," as it may be called, spreads. H. H. Richardson started architects to using rock-faced sandstone and Byzantine detail. The influence of his work was superseded by the buff brick and terra-cotta craze set going by McKim, Mead & White's Madison Square Garden, Century Club, and other New York buildings. So was the Flemish bond with dark headers the natural result of a successful revival of this kind of brickwork, which the old buildings of Philadelphia and the Southern Colonial houses show was no new thing in this country.

The manufacturer must keep these movements in view and meet the demand of architects with suitable material. To enable him to do this with least expense and trouble is one of the chief missions of THE BRICKBUILDER, and it is exactly in this way that it can be of direct assistance to him.



## BRICK GATEWAYS.

**B**RICK is not only a material *par excellence* for enclosure walls, but for entrances through such walls, or for monumental gate-posts it is one of the most effective materials in the hands of a good designer. As two very good examples of such gate design, we published in our May number the two gates at Harvard University, designed by McKim, Mead & White. One is a drawing, from a photograph, the other is a photographic reproduction. Of course these gates were expensive, but principally for the iron work. The bricks seem to be selected from stock rejected as unfit for the market. Upon close examination it is hard to find a good individual brick, from the manufacturer's point of view, yet the brickwork of these gates excites admiration of every architect. At "Westover," a Colonial mansion in Virginia, are gates, simple to an extreme, yet very effective, and there are numerous other examples, some of which will be published in subsequent issues.

In every city or town of any importance there is considerable expensive fence and wall building, but it is of stone, wood, or iron. Here is a chance for missionary work by the local manufacturer. There may not be opportunity now or for months to come, but remember this when the opportunity does come. In smaller cities, certain things become fads. We remember an instance illustrating this in a city of some twenty thousand inhabitants. A man was repairing an old house and induced a stained-glass firm in a neighboring city to put in a large plate-glass window with a stained-glass panel above it, on the chance of its setting the fashion. Within a year that company had orders for more than twenty similar windows from that city.

A wide-awake brick manufacturer, working with an intelligent mason contractor, could make the brick fence a "fad," by getting one job and doing it well. We would only too well like to co-operate with him, from start to finish. If the owner does not at once fall in with the idea, let us help convince him by sending him photographs and sketches of similar work already built. It is exactly the position we want to hold towards the manufacturer, — that of being an assistance in opening up and broadening his market. This department can only be in the roughest way suggestive. It is by direct correspondence on special work by hunting up and sending to him photos, sketches, by putting him in the way of getting designs, etc., etc., that we can best help him; and in return for any such services we ask nothing but that he subscribe to, and read, *THE BRICKBUILDER*, and use it in every way possible to increase his sales. By enlarging his own business he directly helps us.

## THE COURSE IN CLAYWORKING, OHIO STATE UNIVERSITY.

**F**ROM the very first *THE BRICKBUILDER* has strongly advocated the establishment of a scientific course of instruction in clayworking, in connection with one of the large technical schools. It has argued that clayworking is no more "practical" than the mining, iron working, or textile industries in which, as in every branch of manufacture nowadays, a technical training is of the greatest assistance. The idea of "college men" becoming good brickmakers has been ridiculed by the class of men in the industry who don't believe in improved methods of manufacture, and who value experience beyond everything; and well they may, for that matter, for "experience" is costly. But as this class do not and never will read *THE BRICKBUILDER*, what we have to say will affect them in no way.

The men in the clayworking industry who are striving to bring their art nearer perfection will give their heartiest support to the new course established under the able management of Prof. Edward Orton, Jr., at the Ohio State University, Columbus. This course is known as the Department of Ceramics and Clayworking. In its general principles of Chemistry, Mineralogy, and Geology will be taught, with enough mechanical engineering and

shop-work to meet most requirements. Practical Clayworking will be studied in its application to the several divisions of the industry. Every clayworker should supply himself with the prospectus of the school, and do his best to promote its growth into a large and useful institution.

**T**HE July *Clayworker* contains some good stuff on pages 45 and 49 relative to brickmakers using their own product. It is something we have done considerable pegging at, though why it should be necessary is beyond our comprehension. We have known of lumbermen building brick houses, but there is good reason for that, while the brickmaker who builds his house or office of wood is lacking somewhere in his headpiece.

## ROMAN SHAPE COMMON BRICK.

**T**HE following letters received since our last issue are especially decided in favor of this stock:

FRANCIS R. ALLEN, 220 Devonshire Street, Boston.

"I am of the opinion, very decidedly, that they would meet with a very large sale. I know that personally I should use them in preference to the better quality in many places.

"They would give a texture which cannot be obtained with any material at present available."

JARDINE, KENT & JARDINE, New York.

In regard to common brick made in Roman shape we feel certain we could make frequent use of them, and for some time have wished we could obtain them as easily as the ordinary shape. They have been used with great success in modern work, the effect being a delight to the eye. We feel sure that clients would willingly pay a little extra for them, because even now they are willing to pay extra for the yellows, drabs, grays, etc., of firebrick.

We wish to add a word as to the excellence of your periodical. It is by far the best publication proportionate to the cost which comes to us among a number of architectural papers. We wish you continued success.

**W**E give below the new schedule taken from the Senate-Wilson Tariff Bill on brick and tile, and clays or earths; also the rates under the McKinley and Mills Bills.

## BRICK AND TILE.

	New Rate.	McK. Rate.	Mills Rate.
Brick, not glazed, enameled, ornamented or decorated in any manner, ad valorem	25%	\$1.25 ton	20%
Glazed, enameled, ornamented, or decorated, ad valorem	30%	45%	20%
Magnesian fire brick, per ton	\$1.00		
Tiles, plain, not glazed, ornamented, painted, enameled, vitrified, or decorated, ad valorem	25%	25%	20%
Ornamented, glazed, painted, enameled, vitrified, or decorated, and all encaustic, ad valorem	40%	45%	20% to 45%

## CLAYS OR EARTHS.

Clays or earths, unwrought or unmanufactured, not specially provided for, per ton	\$1.00	\$1.50	Free
Wrought or manufactured, not specially provided for, per ton	\$2.00	\$3.00	\$3.00
China clay, or kaolin, per ton	\$2.00	\$2.00	\$2.00

Upon receipt of five two-cent stamps we will mail to any address in the United States a copy of the Senate-Wilson Tariff Bill, pamphlet form.



## TRADE NOTES.

## Yard Equipment.

**C**HAMBER BROS. COMPANY are to equip the new paving-brick plant of T. B. McAvoy & Sons, Philadelphia.

**T**HE contract for equipping the extensive new brick plant at Cuyahoga Falls, O., has been given the Frey-Sheckler Co., Bucyrus, O.

**T**HE Mill Hall Brick Works, Mill Hall, Pa., have recently had their yard equipped by the Simpson Brick Press Company, and report entire satisfaction with the result.

**T**HE new Chisholm, Boyd & White Company will stick to the old concerns methods of making brick machinery as they have always filled all requirements in the most satisfactory manner.

**M**R. SIMPSON, the senior, pays a deserving tribute, by leaving the affairs of his extensive brick-machinery plant in the hands of Mr. Simpson, the junior, while he takes a well-earned sojourn in Europe.

**O**N Aug. 1, 1894, the well-known firm of Chisholm, Boyd & White, Chicago, manufacturers of the Boyd Brick Press, was succeeded by The Chisholm, Boyd & White Company. J. A. Boyd, president; B. C. White, vice-president; S. S. Chisholm, secretary and treasurer, with H. J. Flood and H. W. Boyd as directors in connection with the three officers named.

## Clay Materials.

**T**HE PERTH AMBOY TERRA-COTTA COMPANY are doing the Tremont Temple (Boston) work for Blackall & Newton.

**T**HE Excelsior Terra-Cotta Company of New York have recently secured several good contracts in the New England field.

**M**R. W. H. Powell, treasurer and general sales agent of the Excelsior Terra-cotta Co., while in town recently made arrangements with W. H. Gates to handle the New England business for his concern.

**T**HE JARDEN BRICK COMPANY have recently sold quite a large number of their buff bricks for buildings being erected in Boston. Mr. R. F. Stahl, Hancock Building, is their agent in this city.

**R**IGHT here in New England may be found one of the best equipped terra-cotta plants in the country. We refer to the New Britain Terra-Cotta Company, Berlin, Conn.

**T**HE contract for the terra-cotta for the new Masonic Temple at Augusta, Me., has been given to the Excelsior Terra-Cotta Company, through W. H. Gates, their Boston agent. J. C. Spofford is the architect.

**N**EW YORKERS will soon have an opportunity to see the beautiful white brick made by the Powhatan Clay Company of Richmond, Va., as some are now being furnished for an eleven-story building on Broadway.

**T**HE GLENS FALLS TERRA-COTTA COMPANY has been busy thus far this season, and at the present time is so rushed that material promised us for publication cannot be prepared for several weeks to come. This is a pleasant condition for the company, but it is inconvenient for the paper.

**T**HE BROOKE TERRA-COTTA COMPANY of Lazeurville, W. Va., want to secure agents in all the principal cities to handle their line of cream brick and other shades of buff pressed brick, on commission. Mr. T. W. Carmichael, the manager of the company, will be pleased to correspond with parties desiring further particulars.

**T**HE new mottled brick made by the Gay Head Fire Brick & Clay Co., Chelsea, Mass., seems to have met with a cordial reception in the market. We learn from Mr. W. H. Gates, who is the exclusive agent, that he has recently placed a large number of the same in Boston and the other New England Cities.

**M**ESSRS. EUGENE R. ATWOOD and William H. Grueby, formerly managers of the Faience Department of Fiske, Homes & Co., have both commenced the manufacture of glazed and enamelled terra-cotta, independently. Mr. Atwood has organized a company at Hartford, and Mr. Grueby at Boston, taking a portion of the Fiske, Homes & Co. plant at South Boston.

**T**HE YALE BRICK COMPANY of Berlin are burning a kiln of pressed brick, from which great results are looked for.

The Yale brick is fast gaining a strong foothold with architects and builders and, wherever used, has given the greatest satisfaction, which reflects great credit upon the makers.

**T**HE NEW BRITAIN ARCHITECTURAL TERRA-COTTA COMPANY have had plenty to do this month; have gotten out several large orders. This company is able to furnish almost anything the mind can invent in the line of terra-cotta. Special designs are executed by them in the best shape, and, above all, with quick dispatch.

**A** HIGH grade common brick, bright in color, well shaped, fairly smooth and uniform, is in demand, and a manufacturer of such a brick readily finds a market for his goods. It is well worth the attention of brick manufacturers the growing popularity of such a brick as we mention. The architects are using them very freely and procuring some very effective results.

**T**HE DONNELLY BRICK COMPANY of Berlin have been unable to get enough clay the past month to supply the demand for terra-cotta and fancy brick. It is surprising the way this concern's business has increased during the last two years under the skilful management of Mr. M. J. Donnelly. Their terra-cotta and fancy brick department is a comparatively new departure for them, but their enviable reputation in the manufacture of common brick at once placed their fine products in demand, and assured for their latest venture entire success.

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## TRADE NOTES.

WE have received through the courtesy of James A. Davis & Co., Boston, a very attractive little volume entitled "Brick Roadways," issued by the Interstate Vitified Brick and Paving Company of Philadelphia. This work contains an exhaustive treatise on brick pavement, and proves conclusively that, providing the right bricks are used and are properly laid, there is no better pavement known than a vitified brick pavement.

EVERYTHING in connection with the starting of the Clay Workers' School at the Ohio State University is progressing even better than could have been expected. Enough machinery to establish a complete brickmaking department has been given by manufacturers of clayworking machinery, and already applications have been received from many who wish to join the first class.

MR. CHAS. T. HARRIS, well-known to the building trades of the northwest as formerly a member of the firm of Houston & Harris, Minneapolis, has connected himself with the Central Pressed Brick Company, having charge of their Chicago office. We are confident that Mr. Harris has the best wishes of all the building fraternity in his district, and that they will not fail to remember him when selecting goods.

ARLINGTON Street, Boston, from Beacon to Marlborough, has lately been brick paved, the Interstate Vitified Brick and Paving Company, 92 State Street, Boston, doing the work. The result has been most satisfactory, and we are not surprised to learn that the city is seriously con-

sidering adopting this method of street paving.

The roadbed was prepared by first having six inches solid concrete, on top of which rest one and one half inches plaster cement, — Alpha brand — into which the bricks were set on edge, and all apertures filled to surface with thin cement mortar. The bricks used were made by the Keystone Vitified Paving Brick Company.

A CHICAGO brickmaker says that the days of the old red brick are passed. A good while ago the brickmaking industry reached its highest perfection in Philadelphia, and the deep red brick of that city were shipped at great expense all over the country, wherever best architectural effects were wanted. But there have been great developments in the art since then, and the pink cream-colored, and bricks of various other hues have supplanted the old red brick in popular favor. This manufacturer says that he can make brick of almost any desired color. He attains this end by mixing with the clay certain metallic substances very finely powdered. He says that he can produce a brick as mottled as a gull's egg; in fact, if you pay your money promptly, the choice is yours. — *Clay Record*.

We cannot agree with the writer of the above article, for while we allow that brick of the various hues that are now being so generally used for fine building fronts has in a large measure supplanted the old red-face brick, we believe it has to a greater extent taken the place of marble, granite, and the various other stones used for fronts. We do not hesitate to say, and our opinion is based largely upon the expressions of many of our leading architects, that, however brilliant the future may be for the colored brick as now

manufactured, the good old red-faced brick will always have its place, and be even used to a greater extent in the future. We may draw a comparison with the electric light, which, being the more brilliant, was generally supposed would supplant gas, but, on the contrary, increased the use of gas. People will have light of all kinds because 'tis light, and so people will have brick of all colors because 'tis brick, and we prophesy the red will hold its own.

IF you don't think we believe in advertising, just look at the spread we make in the last issue of *Clay*, the results of which we have begun to realize already.

THAT little patch of brick paving on Back Bay, Boston, is but the forerunner of many miles to come.



PARTIES who anticipate starting in the brick business can form a pretty close relationship with same by reading just one month's issue of brick literature. Well, that is what we are here for.

WE are in receipt of a four-page circular from Messrs Schwencke, Kirk & Co., of New York, which is filled with very flattering testimonials from many of the leading architects on the merits of "Progress" Direct Black Print Paper. Frost & Adams, Agents, Boston.

SINCE the introduction of machine-made mortar in New York City by the United States Mortar Supply Company of 289 Fourth Avenue, it has been almost exclusively used in the finest and most costly buildings being erected in that city, as shown by the following buildings in which it has been used for plastering: Manhattan Life Insurance Company's Building, Home Life Insurance Company's Building, Corn Exchange, and Bowery Banks, American Theatre, The "Life," Schermerhorn, Scribner, American Surety, and Roosevelt Buildings, Buckingham Hotel, Seton, St. Luke's, New York, and Post Graduate Hospitals, Harvard Club, and residences of John Jacob Astor, Elbridge T. Gerry, and W. V. Brokaw. It is also being used extensively for bricklaying.

AMONG the many buildings lately equipped with the "Swinging Hose Rack," Jno. C. N. Guilbert, patentee and manufacturer, No. 39 Cortlandt St., New York, have been: Soldiers' Orphans' Home, Normal, Ill.; Model Steam Laundry, St. Paul, Minn.; Permanent Block, Cleveland, O.; Mississippi Cotton Oil Co., Jackson, Miss.; "Hotel Anthracite," Carbondale, Pa.; Glendale Zinc Co., St. Louis, Mo.; Residence of C. D. Day, Harrison, N. Y.; Providence Athletic Association, Providence, R. I.; Portland Savings Bank, Portland, Me.; Iowa Hospital for the Insane, Mt. Pleasant, Ia.; Notre Dame du Sacred Heart Church, North Adams, Mass.; Purdue University, Lafayette, Ind.; Steamer "City of Lowell," New London, Conn.; Mohawk Valley Cap Co., Utica, N. Y.; Richards Paper Co., South Gardner, Me.; King's Court Apartments, New York City.

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